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## The Accident Victim

### A VITAL NEED FOR IMMEDIATE, CONTINUED AND EXPERT CARE

#### EMERGENCY CARE OF THE INJURED

At last the care of the injured is beginning to receive the attention it deserves. Trauma centres, burns units, and Emergency Departments are becoming well-manned and equipped. Intensive Care Units are proliferating and there is even a sign that ambulance services in Canada will be coordinated and staffed by well-trained personnel. Medical schools are beginning to teach the essential ingredients of emergency care. There is still a lot to do to improve the situation. Hundreds of Canadians die or sustain unnecessary morbidity because of inadequate treatment, delay in transport, or lack of appropriate facilities.

While expert care may be instantly available at a major hospital, this is not always so in more remote centres; and in some instances, the victim may even succumb from insufficient care during transport to hospital. We have no coordinated over-all accident service for Nova Scotia yet alone a national organization, such as "Trauma Canada" advocated some years ago.

Jim Scott<sup>1</sup>, a Canadian surgeon, spent his life in Oxford, England, developing one of the earlier accident units. Reviewing 40 years experience, he criticized the British National Health Service for its lack of planning of accident services, "An entity and a problem to be recognized, accepted, and talked about; but, a nettle which under no circumstance is to be grasped."

"There is still a great need for men who will see the whole problem in organization and relate it to the quality of care and who will be able to insist on a standard which is sustained in an integrated unit from the admitting door of the hospital to the return to full function and employment, and to participate effectively in this programme." Such a person was William Gissane,<sup>2</sup> director of the Birmingham Accident Service. Thanks to his leadership, this hospital built up a reputation not only for efficient care of the injured, but of research specifically designated to related problems. These include organizational aspects, engineering and mechanics of accidents, physiology of trauma, and pathology of injuries as well as the medical and surgical management and documentation. Both Scott and Gissane decry the general opening of emergency departments to all emergencies, without segregation, and advocate specially trained teams and units to care for the traumatized victim. R. Snook<sup>3</sup> gives an excellent outline of medical care at accidents and disasters.

A long range reliable communication is essential between the central control room and accident teams. Fire, police, and ambulance services should be closely coordinated. Ambulance personnel and equipment should be expertly prepared, protective clothing should be available against chemicals and respiratory protection. The equipment and vehicles form part of an integrated plan.

Triage and documentation form the basis of accident management. Casualties should be classified as:

- (1) Immediate
- (2) Delayed (can wait)
- (3) Palliative (must wait)
- (4) Minor
- (5) Dead

Color coding should be used for personnel, control vehicle, and documents.

How does Nova Scotia compare with these standards? This journal is pleased to include important articles by Dr. McDermott who carefully analyses the initial examination of the multiply-injured patient, a subject recently also covered by Dr. McMurtry of Sunnybrook Hospital in Toronto during his visit to Halifax.

Dr. Petrie has recently drawn attention to deficiencies in the organization of our emergency services. Whilst the ambulance service for Nova Scotia costs 2 1/2 million dollars a year, there are no set standards for ambulances, equipment, or personnel, and there is no central control. The ambulance service is under the Department of Social Services and not the Department of Health. There is a need for a Medical Director of Emergency Services with specialist qualifications — someone of the calibre of Jim Scott or William Gissane.

New approaches in Intensive Care, particularly concerning alveolar capillary leaks syndrome, are described in this journal by Dr. Allen. It is not only at the major centres, where teams of physicians and technicians are available, that lives can be saved. Dr. Naqvi of Sydney presents a detailed analysis of cases treated in Intensive Care Units in Cape Breton and shows what can be done by a group of active physicians in a peripheral hospital.

In 1976 an explosion in the Courthouse in Boston<sup>4</sup> caused twenty casualties. Ambulance response was made in 2.5 minutes and all victims were transported from the scene within 20 minutes. This successful management entailed careful disaster planning, on-site stabilization, and treatment of the casualties and close coordination of all agencies.

The overall organization and individual management of the accident victim remains the concern of a few individuals. We should ensure that the modern techniques and equipment and trained personnel should be integrated to a service available to any individual in Nova Scotia.

### THE WORKMEN'S COMPENSATION BOARD

Considerable criticism has been levelled by patients and doctors about this organization. Articles in this journal endeavor to refute these claims and to explain the frustrations that may arise for unsatisfied participants.

Dr. Dobson describes the development of the Board from its conception in 1915 to the present date. Some 30,000 patient claims are now paid each year, with disbursements of 21 million dollars and expenses of 3 1/2 million. Although doctors may complain of extra paperwork and delay in paying of fees, this is usually a result of poor communication on the part of the physician. The appeal system, in effect since 1975, has also been criticized and its costs have risen to \$800,000 for administration and awards. A system, whereby independent specialists should be consulted for assessment of permanent partial disability, has been suggested along the lines of similar arrangements in Ontario.<sup>5</sup>

Dr. Weil's article explains many of the problems that face injured workmen. A critical period of six weeks seems to separate the acutely injured who returns to work without complication from the chronically unemployed whose domestic pressures and financial commitments make adjustment difficult. He makes a plea for early psychiatric assessment before the patient's problems have become impossibly complex.

A recent review of the Ontario Compensation Board<sup>6</sup> also emphasizes the importance of better communication between the Board and physicians and the value of research in the results of different methods of management.

It is hoped these articles will stimulate further contributions on the subject, so that the cooperation of physicians and Workmen's Compensation Board can lead to a universally satisfactory outcome for the accident victim and his family. □

B.J.S.G.

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# The Initial Examination and Management of the Multiply-injured Patient

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## SUMMARY

The care of the patient with multiple injuries depends upon the physician's judgment in establishing treatment priorities. This paper describes a simple ABC approach used in the initial management of these patients.

It is very important that every physician working in an Emergency Department develop an approach towards the management of the multiply injured patient. Such a routine must be simple, accurate and complete. Table I, which outlines the ABC's of management, is an easy guide for remembering the priorities in caring for these patients.

**TABLE I**  
**PRIORITIES IN MULTIPLE INJURIES**

- |                                   |
|-----------------------------------|
| A. Airway                         |
| B. Bleeding and Blood Circulation |
| C. Cerebral and Cervical Spine    |
| D. Digestive                      |
| E. Excretory                      |
| F. Fractures                      |

## INITIAL IN-HOSPITAL MANAGEMENT

The care of the acutely injured patient imposes certain important time restrictions upon the physician. He must not only carry out his usual diagnostic evaluation, but must also attend to the urgent therapeutic needs of his patient. It is frequently impossible to get an adequate account of the patient's injuries and how they occurred for various reasons: pain, head injury, influence of alcohol, etc. The physician therefore must rely heavily on physical and radiographic examination for diagnosis. In order to avoid focusing on obvious injuries and missing others that are not apparent, all the patient's clothing should be removed; scissors should be used to avoid undue movement of possible fractured limbs or spine.

### A. AIRWAY

#### 1. Upper Airway Obstruction

The initial examination should always centre around the respiratory system. As you enter the room look at the patient's overall color and determine his ability to talk normally as this will preclude any major airway obstruction. Check for changes in the rate and character of respirations as well as evidence of indrawing, especially of the suprasternal notch supraclavicular fossa. Listen for stridor or crowing sounds, suggesting upper airway obstruction.

The most common source of inadequate ventilation in acute trauma is upper airway obstruction. This is frequently

caused by the tongue falling back in the throat, and the airway may be improved dramatically by simply elevating the posterior angles of the jaw and inserting a plastic oropharyngeal airway. If the obstruction is caused by blood, vomitus, teeth, etc., lateral positioning and suctioning are necessary. Remember that the unconscious patient should be rolled like a log in one piece to avoid twisting a possibly injured cervical spine.

In desperate situations with complete or near complete upper airway obstruction secondary to extensive injuries to the face, mandible, larynx, or entrapped foreign bodies in the larynx, a cricothyroid stab should be performed. The cricothyroid membrane can be identified by feeling for the transverse indentation, which is located about one-half inch below the Adam's apple. This area is relatively avascular so that serious bleeding should not occur. A sharp instrument is inserted transversely so as to obtain a sufficient opening. Once the trachea has been entered, stiff rubber tubing is used to keep the edges of the incision apart. Irreparable damage to the larynx occurs if this aperture is left open for longer than six hours. Intubation is a skill that all physicians working in an Emergency Room should acquire. Once in place, a cuffed endotracheal tube ensures a cleared upper airway, prevents aspiration, allows for adequate suctioning as well as positive pressure ventilation.

#### 2. Chest Injuries

Examination of the chest is then performed. Check for open sucking chest wounds and the paradoxical motion of a flail segment. Feel for areas of tenderness, subcutaneous emphysema and tracheal displacement. Compress the sternum. Auscultate for abnormal or absent breath sounds.

Fractured ribs are a commonly seen chest injury. Radiologically they can be seen on a simple AP view, especially if looked for along the lateral margins of the rib cage. Rib fractures can give a pneumothorax due to puncture of the pleura as well as hemothorax secondary to bleeding from the intercostal vessels. Look especially for fractures of the first rib as there is often associated neurovascular problems of the ipsilateral arm. Fractures of the first three ribs are seen in a large number of patients with partial or complete tears of a bronchus. Fractures of the ninth to eleventh ribs are apt to be associated with splenic or hepatic injury. A stove-in island of chest wall can lead to flail chest and paradoxical movement of the involved segment, and subsequently compromise ventilation. This injury is internally splinted with intubation and continued positive pressure ventilation. Open chest wounds are covered immediately with occlusive vaseline gauze dressings, preferably after deep expiration.

A tension pneumothorax is always a possibility. In this situation, air collecting in the pleural space under increasing positive pressure causes displacement of the mediastinal

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structures in the opposite direction, resulting in compromise of venous return and cardiac function. Immediate decompression can be performed by inserting a large gauge needle into the second intercostal space anteriorly at the midclavicular line.

Rupture of the diaphragm commonly results from blunt abdominal trauma. The sudden increase in intra-abdominal pressure aided by the negative intrathoracic pressure, causes the rupture and at times allows for movement of the abdominal contents into the thoracic cavity. The immediate danger is hypoventilation. Diagnosis can be confirmed by passing a nasogastric tube into the stomach and then taking a chest X-ray after injecting a small amount of water soluble dye down the tube.

## B. BLEEDING AND BLOOD CIRCULATION

### 1. Cardiogenic Causes of Shock

As soon as adequate respiratory function is insured, attention should be paid to the cardiovascular status of the patient. In the patient with trauma to the chest, cardiogenic causes of shock (cardiac tamponade, cardiac contusion and rupture of the great vessels) should be sought for first. Distended neck veins with decreased arterial pressure and muffled heart sounds point toward cardiac tamponade. The restriction of cardiac filling by intrapericardial blood, resulting in a life threatening low output syndrome, can usually be resolved rapidly by needle aspiration. All patients with severe anterior chest wall pain following trauma should have an electrocardiogram to diagnose a cardiac contusion. The complications of this injury are the same as an acute myocardial infarction and should be treated in a similar manner.

Figure 1 illustrates the chest x-ray of a young boy who was admitted in shock with back and chest pain following a motor vehicle accident. The chest x-ray revealed a widened mediastinum and subsequent arteriography showed a complete tear of the thoracic aorta at a level distal to the left subclavian artery as seen in Figure 2.

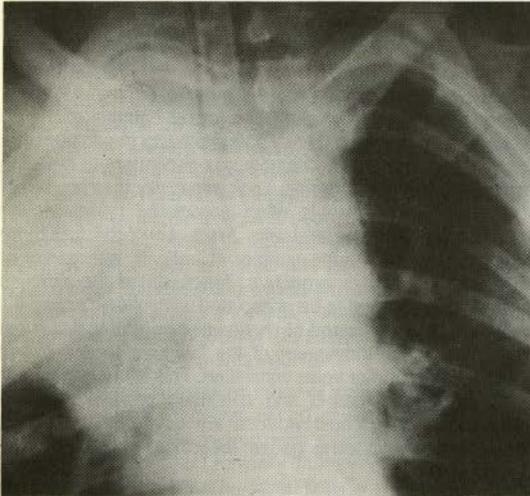


FIGURE 1

Chest x-ray reveals a widened mediastinum.

### 2. Hypovolemia

Hypovolemia should be treated first and its cause, if not evident, sought for later. When necessary, two large gauge intercatchs (14 or 16 gauge) should be inserted and a balanced salt solution given. In a patient that is peripherally vasoconstricted, a subclavian line should be inserted. This technique involves puncturing the subclavian vein at its course under the clavicle. At the junction of clavicle and first rib, the needle is inserted at thirty degrees towards the suprasternal notch until blood is drawn back. Following this an intercatch is threaded through the needle into the superior vena cava. Physicians seeing a lot of trauma should be familiar with this technique. In an emergency, a similar and somewhat easier puncture can be made at the site of the femoral vein. Both procedures have their complications and should be used when large volumes of fluid are needed quickly or central venous pressure readings are sought.

### 3. Peripheral Arterial Injuries

Remember also to check for abnormalities of peripheral arterial circulation. Injuries of the subclavian, brachial, iliac, femoral and popliteal arteries are not that uncommon. A completely severed artery is easily recognized by the five P's (pain, pulselessness, paresthesia, pallor and paralysis). Because of constriction and retraction hemorrhage is usually not a problem in a completely severed artery. Conversely, the partially severed artery often gives rise to continued bleeding because of lack of retraction.

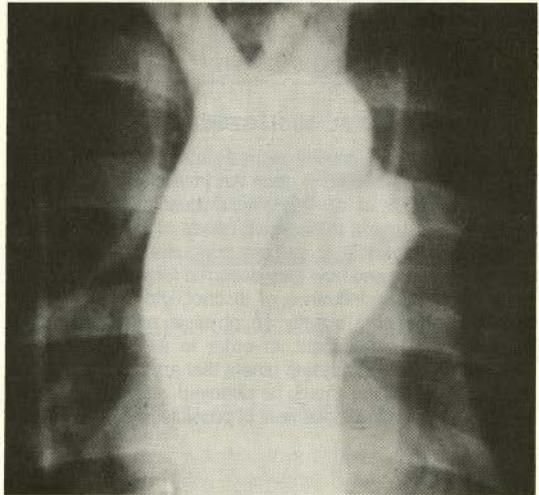


FIGURE 2

Arteriography shows complete tear of aorta below subclavian (L).

## C. CEREBRAL AND CERVICAL SPINE

### 1. Head Injuries

In the emergency management of head injuries, a quick neurological evaluation is sufficient. The patient's head should be carefully inspected and palpated for lacerations and depression of the skull. Eardrums should be inspected routinely for the presence of blood in the middle ear suggesting a basal skull fracture. Bleeding from the nose may also indicate involvement of the paranasal sinuses by a fracture. Figure 3 illustrates the typical double ring discharge

on the bedsheet that occurs when blood is mixed with cerebro-spinal fluid as in this patient with rhinorrhoea.

The relative size, equality and response to light of the pupils should be observed and recorded. Check the fundi for venous pulsations. Papilledema is not seen in the acute head injury, but will be present in the patient with a large sub-acute or chronic subdural hematoma. Bilateral constriction of the pupils suggest pontine involvement. Unilateral dilation and fixation of a pupil indicates a third nerve palsy associated with a progressively expanding lesion. Under such circumstances, the patient's level of consciousness will be markedly depressed and immediate surgical intervention needed. If, however, the patient's level of consciousness is normal, then the dilation is probably due to local orbital trauma.



**FIGURE 3**

Typical double ring discharge on bedsheets.

A change in the level of consciousness is the most reliable means of determining the patient's progress. Avoid terms like "semi-comatose", "stuporous" and record the specific response of the patient to given verbal and/or painful stimuli. Frequent and accurate assessments are needed. Check the vital signs at the same time. Bradycardia, vomiting, increasing blood pressure, a change in the character and rate of respirations are all indications of increasing intracranial pressure.

The patient's motor activity should then be evaluated. If the patient is conscious, this is easily appraised by having him resist passive motion of the extremities. In the comatose patient the degree of muscle tone is tested by lifting the extremity and letting it drop. The deep tendon reflexes as well as plantar and abdominal reflexes are then checked. An intracranial lesion may produce increasing hemiparesis, increasing spasticity with increased muscle tone, increased deep tendon reflexes, ankle clonus and Babinski sign. The development of decorticate or decerebrate posturing is indicative of midbrain involvement and carries a poor prognosis.

X-rays of the skull can be helpful especially if the pineal gland is calcified, since a shift of its midline position in the

A-P view suggests a lesion. The films may show depressed fractures or fractures that traverse arterial vessel grooves in the skull (middle meningeal artery). Further they may outline air within the skull as well as the presence of a foreign body. A linear skull fracture is of consequence only when there is clinical evidence of injury to the brain. Complete radiographic examination of the cervical spine (including C7) is mandatory in all patients with severe head or facial trauma because of the high incidence of associated injuries.

In a patient with an extradural hematoma, there is usually a history of a brief period of unconsciousness followed by a lucid interval of variable duration. Afterwards the patient usually complains of a severe headache and quickly becomes completely unresponsive. Treatment consists of immediate trephination. Because of the urgency of this situation, no attempt should be made to transport the patient to the regional neurosurgical centre but rather the burr holes should be done at the local hospital.

Since the brain is encased within a rigid structure, sudden bleeding or massive edema will cause intracranial hypertension. Prompt intubation with hyperventilation to blow off excessive CO<sub>2</sub> as well as the early intravenous administration of hypertonic glucose (50 ml 50% glucose bolus) and 20% mannitol (200-300 ml) may be lifesaving in certain situations by temporarily lowering intracranial pressure. These agents should not be used indiscriminately. They are only given to buy time after a diagnosis and decision to operate has been made.

## 2. Spinal Injuries

In the conscious patient, local tenderness is the most common finding with vertebral column injury. Gently palpate the spinous processes of the cervical and lumbar spine without moving the patient. Thoracic spine injury is tested for by compressing the sternum. This manoeuvre transmits the force posteriorly and will give pain in the area of injury. Carefully check and record motor and sensory abnormalities, reflex changes and bowel and bladder function. The unconscious patient should always be assumed to have spinal injury until a complete radiographic examination of the spine has been completed. All patients suspected of having a spinal injury should be transported on a fracture board with sand bags immobilizing the head and neck.

## D. DIGESTIVE

### 1. Blunt Abdominal Injury

All the abdominal organs are vulnerable to blunt injury. This may occur when the viscus is crushed against the vertebral column or is violently displaced on its mesenteric attachments. It is not unusual to have little or no evidence of intra-abdominal injury at the time of the first examination and therefore repeated examinations are needed over time. Look for abrasions or contusions over areas covering the vital organs. Palpate for tenderness, distention, and seek signs of peritoneal irritation, remembering that intraperitoneal blood does not necessarily give you those signs. Check for bowel sounds.

A nasogastric tube should be inserted as this will decompress the stomach, especially with acute gastric dilation, as well as help in the diagnosis of injury to the stomach. The most serious intra-abdominal injury is laceration of the liver or spleen. Diagnosis is made by peritoneal

lavage. The procedure is carried out simply by catheterizing the bladder of the patient and then inserting a trochar under local anesthesia through a midline stab wound below the umbilicus. If there is a local surgical scar, a similar insertion should be made laterally along the outer margin of the rectus sheath. If blood immediately comes back through the tube, then the tap is considered positive and arrangements are made for laparotomy. However, if blood does not freely come back through the trochar, then one liter of Ringer's lactate is instilled into the abdomen and subsequently drawn off. In experienced hands, the false positive rate using lavage is less than 10%. Perforation of the small bowel is the most frequently ruptured hollow organ and occurs at points of fixation, i.e. the ligament of Trietz, the terminal ileum, or at a point where an adhesion is present from previous surgery. The duodenum and pancreas lie anterior to the spine and may be involved in a crushing injury against this bony structure. Injury to these organs results in a leak retroperitoneally and the late onset of signs. Radiologically, the presence of a reactive scoliosis, obliteration of the right psoas shadow and air bubbles around the right kidney point toward a ruptured duodenum.

## 2. Penetrating Abdominal Injury

It should be routine to inspect carefully the buttocks and perineum, as well as the back and flanks for evidence of penetrating injury. If suspected, a sinogram with water soluble contrast material should be injected into the wound with a plastic jelco needle, to determine whether it enters into the peritoneum. However, clinical criteria alone are still the best way to decide on operative or non-operative management.

## E. EXCRETORY

### 1. Urethral Injuries

Any individual with blood in the urine or at the tip of the urethra, hematoma of the peritoneum, or who is unable to void, should be evaluated with the urethrogram. Direct trauma to the perineum will give a tear of the anterior urethra. In males with a fractured pelvis involving the pubic or ischial rami, a tear of the membranous-prostatic urethra can also occur.

A simple and safe way to do an urethrogram is to take a #18 or #20 Foley catheter, insert it so that the balloon at the tip of the catheter is just inside the urethra, and then inject one or two ml of air into the balloon. Do not use any lubricant. This allows you to keep your hands out of the way of the x-ray field and also seals the tip of the penis so contrast material cannot escape. Following this, inject ten to twenty ml of contrast material through the catheter.

### 2. Renal and Bladder Injuries

Patients with muscle spasm, bruising, flank pain and a positive psoas sign should be suspected of having renal damage. Extra capsular and collecting duct injuries, as well as injuries to the arteries, veins and ureters can be picked up by IVP. Following the IVP, a cystogram should be performed to complete the examination. Most ruptures of the bladder are extraperitoneal but in some instances the dome of the bladder can rupture intraperitoneally, especially if the bladder is full at the time of injury. A cystogram is easy to perform by inserting a catheter and injecting 200 ml of water soluble contrast material. An x-ray is taken while the catheter is clamped and again post void.

## F. FRACTURES

Injuries to the musculoskeletal system are among the most common encountered in the Emergency Department. In many instances, diagnosis will be apparent on the basis of simple physical examination. Local tenderness, deformity, swelling, loss of function, as well as neurovascular injury are all suggestive of a fracture. An obvious fracture may distract the attention of the casual examiner from the less apparent injuries. Remember that a fracture of the femoral shaft can camouflage an associated dislocation of the hip; and a fracture of the os calcis can distract one from examining the spine.

Fractures should be splinted before the patient is moved from the scene of an accident. If standard external splints are not readily available, improvised splints should be prepared. Early splinting minimizes discomfort, limits local extravasation and loss of blood, and prevents to some degree the secondary damage that may occur with displacement of the fracture fragments. Remember that considerable blood loss can occur in association with a fracture. Compound wounds should be covered with sterile saline soaked dressings and early intravenous antibiotic coverage given.

## CONCLUSION

Reference has already been made to the importance of selected x-ray studies in the diagnosis and management of a variety of injuries. If the patient is acutely ill, the nurse and physician should go to the X-ray Department with the patient while films are being taken. The sequence in which the films are taken should be well thought out and an effort should be made to avoid repeat trips to the X-ray Room for further films. On many occasions the radiologist can recommend the films and techniques that will be of greatest value with least risk to the patient. However, there will be times when the physician will be forced to read his own films and every effort should be made towards developing some skills in this regard.

The complicated nature of multiple injuries frequently requires consultation with a variety of specialists. After initial stabilization and emergency treatment, these patients are usually transferred to more specialized centres for continuing care. Unfortunately, transportation is frequently not given the attention it deserves. Every attempt should be made to predict the course of the patient's progress while in transit and take measures to avoid catastrophes while they are travelling in the ambulance. This means insuring that the ambulance is well equipped and the qualified personnel accompany the patient en route.

The ABC approach, as outlined in this paper, is a simple guide for remembering the management priorities used in the initial care of the multiply injured patient. □

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# Newer Approaches in Surgical Intensive Care

## PULMONARY OEDEMA

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Pulmonary oedema presents as a not uncommon problem in the Surgical Intensive Care Unit. The aetiology may be apparent from the history and recent clinical events or it may be obscure. It is with regard to the approach to this syndrome that this presentation is concerned.

Pulmonary oedema may be classified in terms of the pulmonary capillary wedge pressure and alveolar protein content. See Table I.

**TABLE I**  
**CLASSIFICATION OF PULMONARY OEDEMA**

1. High pressure (PAWP > 25mmHg + Alveolar protein = 1/3 plasma protein)	
1. Cardiac	— Ischaemic — Valvular — Cardiomyopathic
2. Neurogenic	
2. Low pressure (PAWP normal or low + alveolar protein = plasma protein)	
Adult respiratory distress syndrome or alveolar capillary leak syndrome.	

The high pressure pulmonary oedema of cardiac origin is optimally managed by reducing the PAWP to 14 - 18mm Hg using adequate oxygenation, impedance reduction and if necessary, inotropic support. Neurogenic pulmonary oedema is believed to be caused by profound alpha stimulation together with pulmonary venous vasoconstriction.  $\alpha$ -Blockers such as phentolamine have been described as a specific management for this syndrome.

Causes of the alveolar capillary leak syndrome may be summarized as in Table II. The asterisks denote the commoner aetiologies for patients presenting in our unit at the Victoria General Hospital.

In order to have a rational approach to the optimal management of the alveolar capillary leak syndrome, it is important to understand the basic pathophysiological mechanisms. First, the functional residual capacity (FRC) is reduced because of alveolar flooding and collapse. This, together with decreased compliance, or a stiffer lung, results in a lower resting lung volume when the dynamic equilibrium of the lung and chest wall is reached.

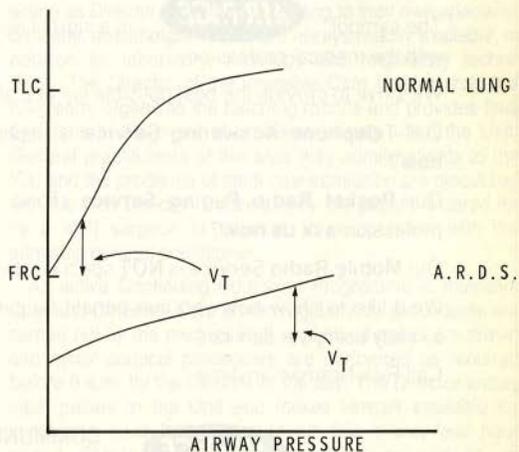
The second, practical pathophysiological effect of reduced lung compliance is that for a given tidal volume ( $V_T$ ) in the patient with severe A.R.D.S. high airway pressures may be required for tidal exchange. This may lead to high alveolar pressures and hence an iatrogenically induced pneumothorax. For this reason, great care should be used in providing large tidal volumes for these patients. See Figure 1.

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**TABLE II**  
**CLASSIFICATION OF A.R.D.S.**

1. Infection	*Gm — ve Sepsis — 40% of patients with Gm — ve sepsis present in respiratory failure
	— Bacterial Pneumonia — Fungal — Viral
2. Trauma	*Lung contusion *Fat Embolism *Hypovolaemic shock syndrome Amniotic fluid embolism
3. Respiration	*Gastric contents
4. Drug induced	Heroin Methadone Propoxyphene Barbiturates Acetyl Salicylic Acid
5. Toxin	*O <sub>2</sub> toxicity *Smoke inhalation Chemical Cl <sub>2</sub> , NH <sub>3</sub>
6. Metabolic	*Pancreatitis *Uraemia *D.I.C.

The third pathophysiological mechanism is venous admixture or shunt effect, produced by the perfusion of the nonventilated flooded alveoli. This in itself produces a low PaO<sub>2</sub>. However, if excessive diuresis is used to promote elimination of lung water to the point of reducing cardiac



**FIGURE 1**

Pathophysiological changes in A.R.D.S.



output, a further PaO<sub>2</sub> reduction will occur. The mechanism here is the further venous dosaturation of the patient's blood exacerbates the hypoxaemic effect of any preexisting shunt.

The guidelines for optimal treatment of the alveolar capillary leak syndrome includes treatment of the cause. The secondary therapy is supportive, and may be described under haemodynamic and oxygenation headings.

In terms of haemodynamic support, these patients are managed with as low a wedge pressure as is commensurate with an adequate cardiac output. Albumin or colloid is used only if volume replacement is necessary but not for the reason of elevating the colloid osmotic pressure. As a guideline, a wedge pressure in the range of 5 to 10mm Hg is aimed for checking the patient's cardiac output by thermal dilution or atriovenous content difference assessment.

In managing the hypoxia, aggressive management of the haemodynamic parameters minimizes sequestration of more lung water and usually permits reduction of the inspired oxygen concentration to 40% in conjunction with best PEEP by 24 to 36 hours.

Steroid therapy is described by Wilson *et al* using methyl prednisolone 30mg/kg q 8h, is used routinely in our unit. However, because of the lack of human evidence for heparinization to prevent the effects of microembolization on lung parenchyma, our patients are not routinely heparinized.

The indication for extracorporeal membrane oxygenation are those described by Hill *et al* and are summarized in Table III.

**TABLE III**  
**INDICATIONS FOR E.C.M.O.**

**Indications:**

1. Rapid deterioration PaO<sub>2</sub> ≤ 50 on F<sub>1</sub>O<sub>2</sub> 1.0 for more than 2 hours with optimal therapy.
2. PaO<sub>2</sub> ≤ 50 F<sub>1</sub>O<sub>2</sub> 0.6 at 48 hours in spite of optimal therapy.
3. Hypoxaemic depression of C.N.S. or C.V.S.

**Contraindications:**

1. Active bleeding
2. Irreversible brain damage
3. Progressive systemic disease
4. Pulmonary disease present for more than 3 weeks

In summary, the optimal treatment of the alveolar capillary leak syndrome requires invasive monitoring of the patient with a Swan-Ganz catheter, IPPV together with best PEEP and elimination of the cause of the syndrome. Special care is needed to maintain an adequate cardiac output, care to avoid oxygen toxicity and care to avoid unnecessary barotrauma to the lung because of relatively large tidal volumes in patients with low lung compliance. □

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# Regional Intensive Care Unit

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## SUMMARY

A Clinical Review of 898 patients admitted to the Intensive Care Unit of the Sydney City Hospital for the period 1973-1976 is presented. The cases comprised of 620 surgical and 270 medical patients. The overall mortality was 9%.

The chief medical problems were due to respiratory disease, cardiac conditions and drug over dosage. There were 34 neurological cases and 19 suffered from diabetic acidosis. Thirty percent of the respiratory cases required tracheostomy.

Surgical cases included head injuries (40% required emergency craniotomy), multiple injuries, severe burns, abdominal emergencies and thoracic injuries.

Patients who had undergone major thoracic and aortic surgery were also admitted to the Intensive Care Unit. Chief cause of death in this surgical group were gastro-intestinal hemorrhage and septic shock.

The authors conclude that an Intensive Care Unit fulfills a twofold function in a peripheral hospital. First to provide care for the more seriously ill patients. Secondly, to recognize an early stage of those patients requiring special treatment, and transferred to a more comprehensive medical centre.

Deaths are summarized in the Appendix Summary.

## INTRODUCTION

A current trend is towards more specialized sub-units or coronary respiratory and terminal care. Computerization of patient care is only a reality in these subunits in large Medical Centres. Unfortunately, in the midst of these advances the greatest need is for better care in smaller Regional Hospitals.

Moylan *et al* recently compared the standard of medical care in five hospitals that ranged from 645-bed university hospital, where "unacceptability of treatment" was 7%, to a 90-bed rural hospital where it was 58%. Treatment errors were more frequent than diagnostic errors and consisted primarily of (1) inadequate treatment of shock by inappropriate blood and fluid replacement, and (2) inadequate respiratory support with little or no airway control or ventilatory assistance.

These initial and basic problems of the critically-ill can be handled in an Intensive Care Unit with alert staff, thereby preventing deaths. Limitations of regional units should be clearly defined as to when patients should be transferred to a larger centre. The regional Intensive Care Unit is a primary treatment centre for critical illnesses. Here frequently industrial, farm and highway accidents are first received.

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The purpose of this paper is to review our experience in Intensive Care over a four-year period. The results are analysed in relation to community needs as well as in comparison with other Intensive Care Units. The effectiveness of the Intensive Care Unit in a regional setting is critically evaluated.

## CLINICAL MATERIAL

The Sydney City Hospital Intensive Care Unit consists of a 5-bed unit within a 150-bed hospital. Sydney has a population of 45,000 people and the hospital acts as a secondary referral centre for a surrounding population of approximately 50,000 people. The nearest university centre (Halifax) is 280 miles from Sydney — 5 hours by ambulance. The hospital also supports a Coronary Care Unit, as a completely separate entity (with an admission rate of 300 patients per year), and a 2-bed Hemodialysis Unit. The Intensive Care Unit admitted 898 patients over a four-year period (1973-1976) while the Coronary Care Unit admitted 1200 patients. A comprehensive Regional Neonatal Intensive Care Unit is located in Sydney's second hospital, which also admits all of the city's obstetrics.

## STAFFING

The Sydney City Hospital emergency department is staffed by general practitioners and at least one duty physician is in the hospital twenty-four hours a day, providing primary care and handling any emergency problem arising from the Intensive Care Unit.

The Unit itself is covered by six general surgeons and four internists who rotate weekends on 24-hour call, with each acting as Director of the day according to their own specialty. Similarly, anesthetists on call are always readily available, in addition to, laboratory, radiology and respiratory technicians. The Director of the Intensive Care Unit controls the ICU team, organizes the teaching rounds and provides final decisions in the event of problems arising within the Unit. General practitioners of the area may admit patients to the ICU and the problems of each new admission are discussed with the Unit Director. Subsequently the patient is cared for by a staff surgeon or internist, in co-operation with the admitting general practitioner.

An active Continuing Education Programme in Intensive Care and Coronary Care is held regularly. All procedures are carried out by the medical staff, and blood gases are drawn and minor surgical procedures are performed as required before 8 a.m. by the Director of the day. The Director knows each patient in the Unit and makes himself available for immediate consultation throughout this twenty-four hour period. Overlap between the six surgeons acts as an effective built-in peer review system, and fosters healthy discussions and a desire to continue to upgrade the patient care.

The nursing staff are responsible for charting biochemical and physical parameters. Daily progress notes are recorded by the Director of the day or the attending physician. The monitoring of these patients is tailored according to individual needs. In most instances basic monitoring of BP, heart rate, pulse rate, respiration, temperature, urinary output, central venous pressure, blood gases, electrolytes and CBC are performed.

### CLINICAL REVIEW 1973-1976

The charts of all ICU admissions from January 1, 1973 to December 31, 1976 were reviewed in detail. The patient's age, sex, admission diagnosis, reason for admission to the ICU, surgical procedures, and complications were recorded. There were a total of 898 admissions, classified according to the primary diagnosis in the hospital and then grouped into medical and surgical (278 medical and 620 surgical).

**TABLE I  
FOUR YEARS I.C.U. STATISTICS**

Total admissions	898
Medical admissions	278
Surgical admissions	620
Average length of stay	8 days
Total deaths	99
Deaths within 4 hours of admission	18
Deaths after 4 hours of admission	81

	1973	1974	1975	1976
1. Total admissions	213	196	218	217
2. Occupancy rate	87.7%	89.2%	95.5%	94%
3. Deaths	24	27	18	30
4. Mortality rate	11.3%	13.8%	8.3%	11%
5. Surgical admission	154	135	162	169
6. Medical admission	59	61	56	102
7. Average length of stay (days)	8	8.3	7.9	6.2

### OVERALL DEATHS

There were 99 deaths in the Unit within 30 days (18 occurred within 4 hours of admission).

**TABLE II  
DEATHS IN I.C.U.**

#### Within 4 hours after admission:

1. Cardio-respiratory arrest due to massive myocardial infarction or respiratory failure	8
2. Cardiac arrest due to dissecting thoracic aneurysm	1
3. Cardiac arrest due to ruptured abdominal aneurysm	1
4. Cardiac arrest due to acute hemorrhagic pancreatitis	1
5. Cardiac arrest due to diabetic coma	2
6. Burns — 100% and 70%	2
7. Pulmonary embolism following colon resection	1
8. Cardiac arrest following resection ruptured cholecystitis	1
9. Cardiac arrest due to drug overdose	1
<b>TOTAL</b>	<b>18</b>

### MEDICAL ADMISSIONS

The medical admissions were divided into six groups — Respiratory, Cardiac, Renal, Drug overdose, Neurological and Diabetic acidosis.

**1. The Respiratory group** included 86 patients. Adult respiratory distress syndrome, pneumonitis and aspiration pneumonia were diagnosed in 39 patients, and chronic obstructive lung disease was the primary diagnosis in 29 patients. Fourteen patients were admitted in 1973, whereas the number of admissions increased to 27 by 1976.

Thirty per cent of the patients required tracheostomy and ventilatory support (from 6-56 days). The tracheostomy was only carried out when the patient was unable to be off the respirator for more than four days and it was considered that the patient would probably require further ventilatory support. One patient with tracheostomy developed tracheo-esophageal fistula and another patient developed postoperative bleeding. Four patients became respirator dependent. Routine tracheostomy cultures were obtained and endotracheal tubes were cultured every third day and upon extubation. A variety of organisms were identified including *Proteus*, *Staphylococcus epidermidis*, *E.coli* and *Aerobacter aerogenes*. Eighteen deaths occurred.

**TABLE III  
RESPIRATORY FAILURE — MEDICAL CASES**

	1973	1974	1975	1976	TOTAL
A.R.D.S.					
Pneumonia	5	9	10	15	39
Aspiration pneumonia					
C.O.L.D.	6	7	9	7	29
Pulmonary embolism	3	5	5	5	18
<b>TOTAL</b>	<b>14</b>	<b>21</b>	<b>24</b>	<b>27</b>	<b>86</b>
<b>DEATHS</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>18</b>

**2. Cardiac Cases** — there were 49 patients, and cardiac arrest occurred in thirteen. Almost all these patients had cardiac arrest in either the emergency room or in the general ward of the hospital and, following resuscitation, were transported to the Unit. Seventeen patients were admitted with congestive heart failure and nineteen patients with acute myocardial infarction. The overall mortality in this group dropped from 50% in 1973 to 21.4% in 1976.

**TABLE IV  
CARDIAC FAILURE — MEDICAL CASES**

	1973	1974	1975	1976	TOTAL
Cardiac Arrest	3	6	4	0	13
C. H. F.	5	3	5	4	17
M. I.	0	4	5	10	19
<b>TOTAL</b>	<b>8</b>	<b>13</b>	<b>14</b>	<b>14</b>	<b>49</b>
<b>DEATHS</b>	<b>4</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>14</b>

**3. Renal Failure** — there were twenty cases with one death.

**TABLE V**  
**CAUSES OF DEATH IN I.C.U. SYDNEY CITY HOSPITAL**

<b>No. of Deaths</b>	<b>Primary Diagnosis</b>	<b>Complication</b>	<b>Cause of Death</b>
14	C.O.L.D. A.R.D.S. Pneumonitis	3 Multiple Organ failure 2 Renal Failure 4 Cardiac arrhythmia 3 Stress ulceration 1 Respirator dependant 1 Pulmonary embolism	1 Cardiac arrest 2 Renal Failure 6 Progressive resp. failure 2 Stress ulceration 3 Multiple organ failure
3	Aspiration pneumonia	A.R.D.S.	Multiple organ failure
1	Pulmonary embolism	Cardiogenic shock	Shock
3	Congestive heart failure	Myocardial infarction	Cardiogenic shock
2	Myocardial infarction	Cardiac arrest Respiratory failure	Cardiac arrest Cardiogenic shock
1	Pericarditis	Pericardial effusion Ascites, Respiratory failure	Respiratory Failure
5	Diabetic acidosis	Cardio-respiratory arrest Tracheostomy Myocardial infarction Necrotizing fasciitis Septic shock	Cardiac arrest Respiratory failure Myocardial infarction Infection Septic shock
3	Bleeding esophageal varices	Uncontrolled bleeding Hepatic coma Hepatic coma	Uncontrolled bleeding Hepatic failure Hepato-renal syndrome
5	G. I. bleeding	Post Gastrectomy jaundice Shock, respiratory failure, uncontrolled bleeding	Multiple organ failure
1	Perforated ulcer	Hypovolemic shock	Cardiac arrest
7	Gastrectomy	Duodenal fistula	Fulminating infection
1	Post-gastrectomy	Femoral embolism	Myocardial infarction
1	Bleeding stress ulcer	Respiratory failure	Multiple organ failure
2	Intestinal fistula	Gram negative septic shock	Infection
2	Perforated colon cancer	Fecal peritonitis	Septic shock
2	Colon cancer	Bowel obstruction Respiratory arrest	Cardiac arrest Respiratory arrest
1	Renal failure	G. I. Hemorrhage	Bleeding stress ulcer
1	Meningitis	Pulmonary edema	Cardiac failure
4	Cerebral hemorrhage	Respiratory failure	Respiratory failure
4	Multiple injuries	Irreversible shock Renal failure Hemopericardium Quadriplegia	Shock Respiratory failure Cardiac tamponade Respiratory failure
1	Fracture hip and tibia	Fat embolism	Myocardial infarction
8	Head injuries	Skull fracture Diffuse cerebral injury Brain stem injury	Massive Brain damage
3	Ruptured abdominal aneurysm	Irreversible shock Renal failure Respiratory failure	Shock Shock Respiratory failure
1	Femoral embolism	Cardiac arrest	Myocardial infarction
3	Acute hemorrhagic pancreatitis	Renal failure Shock Pancreatic ascites and pleural effusion	Renal failure Shock Respiratory failure
1	Carcinoma of bile duct	Intestinal obstruction	Metastases
1	Ascending cholangitis	Pancreatitis	Pancreatic hemorrhage from drain site
1	Carcinoma of liver	Metastasis	Cardiac arrest
1	Multiple subphrenic and paracolic abscess	Colon perforation	Septic shock
1	Antepartum and postpartum Hemorrhage	D.I.C.	Uncontrolled bleeding
1	Portal cirrhosis	Hepatic coma	Hepatorenal failure
1	Post prostatectomy	Rt. Heart failure	Myocardial infarction
1	Total hip replacement	Pulmonary embolism	Respiratory failure

**TABLE VIA**  
**I.C.U. PATIENT CATEGORIZATION AND STATISTICS—MEDICAL CASES**

No.	Diagnosis	Total Admissions	Percentage of Total Admissions	Age (yrs)	Average Stay (days)	No. of Deaths	Mortality Rate
1.	Respiratory failure	86	9.5	60.5	14	18	20%
2.	Cardiac failure	49	5.4	55.6	9.9	6	12%
3.	Renal failure	24	2.6	50	12.3	1	4%
4.	Drug overdose & poisoning	59	6.5	32	2.8	0	0
5.	Neurological cases	34	3.7	55	9.9	5	14.7%
6.	Diabetic acidosis	19	2.1	45	6.8	5	26%

**TABLE VIB**  
**I.C.U. PATIENT CATEGORIZATION AND STATISTICS—SURGICAL CASES**

No.	Diagnosis	Total Admissions	Percentage of Total Admissions	Age (yrs)	Average Stay (days)	No. of Deaths	Mortality Rate
1.	Multiple trauma including head injuries and thermal burn	142	15.8	36	7.5	13	9%
2.	Major thoracic & vascular	194	21.6	62	6	7	3.6%
3.	Gastric	88	9.79	55	11	9	10%
4.	Small & large intestine	85	9.45	60	10	6	7%
5.	Biliary tract & pancreas	45	5	52	9.5	5	11%
6.	Obstetrics, gynecology, Urology	29	3	50	6	2	6.8%
7.	General	44	5.6	55	8	4	9%

**4. Drug Addiction** — fifty-nine patients were admitted due to drug overdose and poisoning. The common drugs included tranquilizers, salicylates and barbiturates, and a suicidal tendency was a prominent feature in these cases. In this group, there were two cases of methyl alcohol poisoning and four with carbon monoxide poisoning. One death occurred within a few minutes upon arrival to the ICU with cardiorespiratory arrest.

**5. Neurological Cases** — there were thirty-four neurological cases. Four patients had status epilepticus, fifteen were comatose on admission, three had meningitis, seven had hepatic coma and five had subarachnoid hemorrhage. Four deaths occurred in this group. No definite conclusion can be made from these cases, since the majority of patients were transferred to the neurological service of the Victoria General Hospital for further treatment.

**6. Diabetics** — nineteen patients were admitted due to diabetic acidosis. Five deaths occurred in this group due to various complications including cardiorespiratory arrest, myocardial infarction and fulminating sepsis.

## SURGICAL CASES

The surgical admissions were divided into seven groups: (1) miscellaneous trauma; (2) thoracic and vascular; (3) gastric; (4) intestinal; (5) biliary tract and pancreas; (6) general (orthopaedic, gynaecological, urological, obstetric).

### 1. Miscellaneous Trauma

There were 142 patients admitted with this diagnosis (head injury — 45 patients; fractures — 66; gunshot wounds — 6; burns — 14; chest injuries — only 5; ruptured spleen — 2; and traumatic amputations — 4.

**TABLE VII**  
**MISCELLANEOUS TRAUMA INCLUDING HEAD INJURY AND THERMAL BURNS—SURGICAL CASES**

Diagnosis	1973	1974	1975	1976	TOTAL
Head Injuries	4	13	9	19	45
Multiple injuries	10	20	18	18	66
Gunshot wound	1	0	3	2	6
Burns	5	5	2	2	14
Chest injuries only	4	1	0	0	5
Ruptured spleen	2	0	0	0	2
Traumatic Amputation	0	0	2	2	4
<b>TOTAL</b>	<b>26</b>	<b>39</b>	<b>34</b>	<b>43</b>	<b>142</b>
<b>DEATHS</b>	<b>3</b>	<b>4</b>	<b>3</b>	<b>3</b>	<b>13</b>

In 1973, there were 26 admissions in this group whereas there has been a gradual increase in the number of admissions and, in 1976, there were forty-three admissions. The increase in the number of admissions could be based upon regional referral, since Sydney is the only city with Intensive Care facilities in the Cape Breton region.

### Head Injuries

Forty percent of the patients with head injuries required emergency craniotomy, thirty percent of the patients were transferred to the Neurological Unit of the Victoria General Hospital for further care and the remainder required supportive care. Head injuries were the major cause of death in this group.

### Skeletal Injuries

Patients who had more than one fracture or associated intra-abdominal and thoracic injuries were grouped under multiple injuries. The trends in admission rate in this group are shown in Table VII. The gunshot wound is a rarity in our region and only 6 such patients were admitted in ICU during the four-year period.

### Burns

As a rule, severely burned patients were transferred to the Burn Unit in the teaching hospital but initial management was provided in the ICU. Fourteen burned patients were admitted, two patients died within an hour.

### Chest Injuries

Most of the chest injuries were part of the multiple trauma. (There were five patients admitted with isolated chest injuries with successful recovery.)

**Ruptured Spleen** — This occurred in patients with severe shock.

**Traumatic Amputation** — Traumatic amputation at the hip level occurred in one patient, and there were four cases of amputation through the knee.

## 2. Thoracic and Vascular

In the vascular and thoracic surgery there were 194 cases. There were 29 thoracic surgery and 66 aortic surgery cases admitted and Intensive Care Unit. No deaths in these elective cases.

Forty-five patients with femoral graft surgery were admitted due to cardiovascular or pulmonary complications; fifteen were admitted due to aortic and femoral embolectomy, and eleven were admitted due to miscellaneous vascular problems. Six patients underwent porto systemic shunting for bleeding esophageal varices, and abdominal aortic aneurysmectomy was carried out in fifteen patients. Ruptured abdominal aneurysm was diagnosed in ten patients.

One patient, with aortic aneurysm resection, developed duodenal fistula and subsequently underwent removal of

**TABLE VIII  
VASCULAR AND THORACIC SURGERY**

Diagnosis	1973	1974	1975	1976	TOTAL
Aortofemoral grafts	10	10	24	22	66
Femoropopliteal Bypass	5	16	12	12	45
Iliac, femoral, popliteal embolectomy	4	3	4	4	15
Porta caval shunt	2	2	1	2	7
Ruptured abdominal aneurysm	2	3	4	1	10
Elective abdominal aneurysm	0	1	2	3	6
Vascular amputations	0	0	2	3	5
Thoracotomy	0	2	3	2	7
Pneumonectomy and Lobectomy	7	1	5	9	22
Miscellaneous	2	2	3	4	11
<b>TOTAL</b>	<b>32</b>	<b>40</b>	<b>60</b>	<b>62</b>	<b>194</b>
<b>DEATHS</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>7</b>

aortic graft and insertion of bilateral axillary femoral graft. Another patient developed septicemia, requiring removal of the graft and insertion of bilateral axillary femoral graft. This group of patients stayed an average of 6.3 days in the Unit.

**Deaths** — There were 7 deaths in this cardiovascular and thoracic group. Three died from ruptured abdominal aneurysm, two following resections, and one following cardiac arrest after femoral embolectomy.

Three patients died due to bleeding esophageal varices, two following portosystemic shunting and one due to progressive liver failure without surgery.

There were no deaths recorded among patients undergoing elective vascular and thoracic surgical procedures.

## 3. Gastric Emergencies

There were 40 patients with massive G.I. bleeding. Four patients were admitted due to perforated peptic ulcer in shock, and six total gastrectomies for gastric cancer. Various other complications following gastrectomies were treated in I.C.U. (post-gastrectomy dumping syndrome — 4; bleeding stress ulcers — 2; duodenal fistula — 1; post-gastrectomy arrhythmias, stomal obstruction and respiratory problems — 16; pyloric obstruction — 1; and revision gastrectomy for gastrojejunal ulcer — 7).

**Deaths** — There were 9 deaths in this group. Five deaths occurred in G.I. hemorrhage group; two patients died prior to any surgical intervention, two died following gastrectomy due to multiple organ failure and one death occurred due to post-gastrectomy bleeding and jaundice.

Three deaths occurred following gastrectomy due to duodenal fistula, femoral embolism and respiratory failure. One patient died following gastrectomy for bleeding stress ulceration due to multiple organ failure. Seventeen patients were admitted in 1976 in comparison to 31 patients in 1973. There were fewer complications in 1976 in comparison with earlier years.

**TABLE IX  
GASTRIC EMERGENCIES — SURGICAL CASES**

Diagnosis	1973	1974	1975	1976	TOTAL
Gastric hemorrhage	11	6	13	10	40
Post-Gastrectomy dumping	2	2	0	0	4
Esophagogastrectomy	1	2	1	3	7
Bleeding stress ulcer	1	0	1	0	2
Duodenal fistula	1	0	0	0	1
Perforated peptic ulcer in shock	2	1	1	0	4
Post-Gastrectomy arrhythmia	7	3	4	2	16
Stomal obstruction					
Respiratory problem					
Revision Gastrectomy for Gastrojejunal ulcer	4	2	0	1	7
Pyloric obstruction	0	0	0	1	1
Gastrectomy for gastric cancer	2	0	4	0	6
<b>TOTAL</b>	<b>31</b>	<b>16</b>	<b>24</b>	<b>17</b>	<b>88</b>
<b>DEATHS</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>9</b>

#### 4. Small and Large Intestine

There were 85 cases in the Intestinal Group. This group constituted patients with large bowel obstruction, perforation (either due to diverticulitis, carcinoma or hemorrhage); intestinal fistula, anastomotic leakage; pelvic abscesses; subphrenic abscess; wound eviseration; septic shock; respiratory failure; pulmonary embolism and nutritional problems. There were 27 patients with colon cancer; strangulated hernia with bowel gangrene — 10; fecal fistula due to anastomotic leakage — 3; perforated bowel — 5; toxic megacolon with twin pregnancy — 1; regional ileitis with multiple fistula and nutritional problem — 2; intestinal obstruction — 29 and abdominoperineal resection for rectal cancer — 8.

There has been progressive improvement in mortality rates in these patients, although the rate of complications in colon cancer has remained the same. In 1973, mortality rate was 11% in comparison to 1976 where mortality rate dropped 4.5%. A total of 6 deaths occurred in this group two due to gram negative septic shock and intestinal fistula from anastomotic leakage; two from fecal peritonitis and septic shock and two deaths occurred following bowel resection due to cardio-respiratory arrest.

**TABLE X  
SMALL AND LARGE INTESTINE SURGERY**

Diagnosis	1973	1974	1975	1976	TOTAL
Colon cancer	3	7	10	7	27
Intestinal resection with strangulated hernia	2	4	0	4	10
Fecal fistula due to anastomotic leak	1	1	1	0	3
Perforated bowel	2	1	1	1	5
Toxic megacolon with twin pregnancy	0	1	0	0	1
Regional ileitis with multiple fistula	0	1	0	1	2
Intestinal obstruction	8	4	9	8	29
Abdomino-perineal resection for rectal cancer	1	1	4	2	8
<b>TOTAL</b>	<b>17</b>	<b>20</b>	<b>25</b>	<b>23</b>	<b>85</b>
<b>DEATHS</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>6</b>

#### 5. Biliary Tract and Pancreas

There were 45 patients admitted due to biliary and pancreatic complications. Ruptured cholecystitis was diagnosed in five patients; acute gangrenous cholecystitis with septicemia in 14 patients; ascending cholangitis with obstructive jaundice in 5; stricture of common bile duct in 2; and acute hemorrhagic pancreatitis in 19 patients.

Five deaths occurred in this group. One death occurred from cancer of the bile duct with ascending cholangitis and intestinal obstruction and liver metastases. One developed pancreatic hemorrhage following common bile duct exploration. Three patients died of acute hemorrhagic pancreatitis due to renal failure, shock and ascites and pleural effusion, respectively. In 1976, mortality rate was only 6.6% in comparison to 1973 when mortality rate was 18.7%.

**TABLE XI  
BILIARY TRACT AND PANCREAS — SURGICAL CASES**

Diagnosis	1973	1974	1975	1976	TOTAL
Ruptured cholecystitis	3	2	0	0	5
Acute gangrenous cholecystitis	3	0	3	8	14
Ascending cholangitis with jaundice	0	2	1	2	5
Reconstruction of common bile duct	1	1	0	0	2
Acute hemorrhagic pancreatitis	9	2	3	5	19
<b>TOTAL</b>	<b>16</b>	<b>7</b>	<b>7</b>	<b>15</b>	<b>45</b>
<b>DEATHS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>5</b>

#### 6. General

The "miscellaneous group" comprised of subspecialty patients in orthopaedic, urology, obstetrics, gynecology and such other patients who were referred to the Unit for major complications from community hospitals. This group included subphrenic abscess — 6; abdominal tumor — 1; wound evisceration — 3; septic shock — 7; laryngeal obstruction for cancer — 4; mastectomy with cardiac arrhythmia — 1; incisional hernia with atrial fibrillation — 1; thyroidectomies — 16; cancer of liver — 1; elective orthopaedic surgical complications — 4; obstetric and gynecological complications — 5; and urological complications — 20. A total of 73 patients were admitted in this group with 6 deaths.

**TABLE XII  
GENERAL GROUP — SURGICAL CASES**

Diagnosis	1973	1974	1975	1976	TOTAL
Subphrenic abscess	4	1	1	0	6
Abdominal tumor	1	0	0	0	1
Wound evisceration	1	1	1	0	3
Septic shock	2	1	2	2	7
Laryngeal obstruction and cancer	2	1	0	1	4
Mastectomy and cardiac arrhythmia	1	0	0	0	1
Incisional hernia with atrial fibrillation	1	0	0	0	1
Thyroidectomies	4	2	5	5	16
Cancer of liver	0	0	1	0	1
Elective orthopedic surgery	1	1	1	1	4
Obstetrics and gynecology	3	1	1	0	5
Urology	4	2	10	4	20
<b>TOTAL</b>	<b>27</b>	<b>12</b>	<b>23</b>	<b>15</b>	<b>73</b>
<b>DEATHS</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>6</b>

#### DISCUSSION

Few papers have been written on Regional Intensive Care in a non-university affiliated setting. The purpose of this paper is to demonstrate that an Intensive Care Unit in such a situation can function efficiently and economically and is essential to adequately care for the critically ill patient.

The Regional Intensive Care Unit differs with respect to patient load but when compared with larger centres, it fulfills a different need. The first important function is to prevent unnecessary deaths while maintaining a high standard of medical care and following the basic principles governing such problems as respiratory failure, upper airway obstruction, blood volume replacement and arrhythmias. The second is to recognize at an early stage, which patient should be transferred, after stabilization, to a more comprehensive medical centre.

Our in-unit mortality rate of 9% over a four-year period compares favourably with many major centres where quoted mortality rates range from 28% to 6.5%. The length of stay per patient, however, was higher and this reflects many factors. The patients with the longest stay were those admitted with respiratory failure — 14 days. In this survey, the average stay of 8 days is contrasted with other studies which range from 57 hours to 6.7 days.

There is frequently a shortage of hospital beds and ICU patients occasionally have to remain in the Unit while waiting to be transferred.

The mortality in 1976, in all groups was considerably less than 1973. This result will clearly indicate that most of them benefit from the Intensive Care Unit.

## CONCLUSION

The authors conclude that it is feasible to support an Intensive Care Unit in a non-university affiliated centre and that it is possible to provide quality Intensive Care for the critically ill patient, when peer and nursing care are constantly reviewed.

In such a unit, all the local resources must be pooled together to provide a multidisciplinary team under the Directorship of one person who has overall responsibility of the organization.

The function of the Regional Intensive Care Unit are:

1. to prevent any unnecessary deaths.
2. to recognize at an early stage which patient should be transferred, after stabilization, to a more comprehensive medical centre. □

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## Vanceril Oral Inhaler

(Beclomethasone Dipropionate Inhaler)

# Vanceril Oral Inhaler

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THERAPEUTIC OR PHARMACOLOGICAL CLASSIFICATION

Corticosteroid Aerosol for the treatment of asthma.

## Indications

Treatment of steroid-responsive asthma.

1. In asthmatic patients who do not respond adequately to conventional therapy.
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## Contraindications

1. In status asthmaticus or in patients with moderate to severe bronchiectasis.
2. Active or quiescent untreated pulmonary tuberculosis.
3. Untreated fungal, bacterial or viral infections of the respiratory system.
4. In children under the age of 6 years.

## Warnings

1. Glucocorticoids may mask some signs of infection and new infections may appear during its use.
2. "THE DEVELOPMENT OF PHARYNGEAL AND LARYNGEAL CANDIDIASIS IS CAUSE FOR CONCERN BECAUSE THE EXTENT OF ITS PENETRATION OF THE RESPIRATORY TRACT IS UNKNOWN. IF CANDIDIASIS DEVELOPS VANCERIL SHOULD BE DISCONTINUED AND APPROPRIATE THERAPY INSTITUTED".
3. In patients previously on high doses of systemic steroids, transfer to Vanceril Inhaler may cause withdrawal symptoms: tiredness, aches and pains, and depression. In severe cases, acute adrenal insufficiency may occur necessitating the temporary resumption of systemic steroids.
4. The safety of Vanceril in pregnancy has not been established. If used, the expected benefits should be weighed against the potential hazards to the fetus, particularly during the first trimester of pregnancy.

## Precautions

1. The transfer of a patient from systemic steroid to Vanceril Inhaler has to be very gradual and carefully supervised by the physician. The guidelines under Dosage and Administration should be followed.
2. A decreased resistance to localized infection has been observed during corticosteroid therapy.
3. During long-term therapy, pituitary adrenal function and haematological status should be periodically assessed.
4. Fluorocarbon propellants may be hazardous if they are deliberately abused. Inhalation of high concentrations of aerosol sprays has brought about cardiovascular toxic effects and even death, especially under conditions of hypoxia. However, evidence attests to the relative safety of aerosols when used properly and with adequate ventilation.
5. It is essential that the patient be instructed that Vanceril Inhaler is a preventative agent which must be taken at regular intervals, and is not to be used during an asthmatic attack.
6. There is an enhanced effect of corticosteroids on patients with hypothyroidism and in those with cirrhosis.
7. Acetylsalicylic acid should be used cautiously in conjunction with corticosteroids in hypoprothrombinaemia.
8. Patients should be advised to inform subsequent physicians of the prior use of corticosteroids.

## Adverse Reactions

No major side effects attributable to the use of recommended doses of Vanceril Inhaler have been reported. No significant systemic effects have been observed when the daily dose was below 1 mg (twenty inhalations). Above this dose, reduction of plasma cortisol, indicating adrenal cortical suppression, may occur. Therapeutic doses may cause the appearance of *Candida albicans* in the mouth and throat. In some patients the appearance of hoarseness or pharyngeal irritation has been observed, occasionally necessitating withdrawal of treatment. The replacement of systemic steroids with Vanceril Inhaler may unmask symptoms of allergies which were previously suppressed by the systemic drug. Conditions such as allergic rhinitis and eczema may thus become apparent during Vanceril therapy after the withdrawal of systemic corticosteroids and should be treated appropriately.

## Symptoms and treatment of overdose

Overdosage may cause systemic steroid effects resulting in symptoms of hypercorticism and/or adrenal suppression. Decreasing the dose will abolish some of these side effects, when due to excessive dosage. Adrenal suppression should be treated symptomatically.

## Dosage and Administration

Optimum doses vary, but the total daily dose should not exceed 1 mg of beclomethasone dipropionate (20 inhalations), and should not be initiated until the severe attack has been controlled with systemic corticosteroids.

**Adults:** Two inhalations (each 50 µg) three to four times/day is the usual maintenance dose. In severe cases it is advisable to control the symptoms with systemic corticosteroids before starting treatment with beclomethasone dipropionate inhaler.

**Children:** Insufficient information is available to warrant the safe use in children under age 6. For children over 6 years of age one inhalation (50 µg) up to four times daily.

**MAXIMUM DAILY DOSE SHOULD NOT EXCEED 20 INHALATIONS FOR ADULTS AND 10 INHALATIONS FOR CHILDREN UNDER 12 YEARS OF AGE.**

Since the effect of Vanceril Inhaler depends on its regular use and on the proper inhalation technique, patients must be instructed to take inhalations at regular intervals. They should also be instructed in the correct method: to exhale completely, lips to be placed tightly around the mouth-piece and actuate the aerosol in the next inspiratory period. In the presence of excess mucus secretion, severe attacks of asthma, and/or infection or high atmospheric concentrations of appropriate antigens, the drug may fail to reach the bronchioles. Therefore, if an obvious response is not obtained after 7 days, appropriate therapy including a short course of systemic corticosteroids should be instituted before returning to the use of inhaler, as well as the concomitant use of a broncho-dilator aerosol.

Careful attention must be given to patients previously treated for prolonged periods with systemic corticosteroids, when transferring them to beclomethasone. Initially, Vanceril and the systemic steroid must be given concomitantly for 10-14 days, followed by a gradual withdrawal of the systemic steroids. Dose reductions should be the equivalent of 1.0 mg every 10-14 days if close continuous medical supervision is not feasible. It may be possible to withdraw systemic corticosteroids more rapidly if the initial dosage was 7.5 mg daily of prednisone (or equivalent) or less, or if the patient is under close continuous medical supervision. Some patients may not be able to completely discontinue the use of systemic steroids. In such cases a minimum maintenance dose should be continued in addition to Vanceril Inhaler.

## Dosage Form

Vanceril Inhaler is a metered-dose aerosol, delivering 50 µg per inhalation. Each canister provides 200 metered sprays.

Full information is published in the Compendium of Pharmaceuticals and Specialties and available on request from Schering Canada Inc., Pointe Claire, Quebec H9R 1B4.

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## INSTRUCTIONS FOR DOCTORS

### FIRST READ THE ENGRAVING ON THE INDENT REVERSE.

Engraved on the back of every Medic-Alert indent is the major medical problem, often contracted to fit, but always quite understandable. First read and then act. You may find there a drug need or a drug to avoid, a chronic illness named, a record of earlier surgery, a prosthesis mentioned that might complicate treatment, or rare blood identified. There are over 200 problems and tens of thousands of combinations.

### LOOK FOR THE PATIENT'S WALLET CERTIFICATE.

The patient should also be carrying a Medic-Alert wallet certificate. This may have an expanded record of the medical problem. It also gives you the member's name, address and phone number along with the name and phone number of the next of kin and the family doctor or specialist.

### USE THE PHONE IF YOU NEED MORE INFORMATION.

By this time you should have all the information on perpetual file, but if in doubt talk to the patient's doctor or the toll free number engraved on the bracelet. Call long distance operator and identify yourself and ask for the record by the member's lifetime serial number which is also engraved on the bracelet back.

### THERE IS A LIMIT SO YOU PROVIDE THE LOGIC

The medical file information is supplied originally by the member, his doctor, or both and it can change. It costs members nothing to have Medic-Alert make all the changes in records as often as necessary. But people procrastinate or forget. This is why Medic-Alert insists that the record is *subject to clinical test and interpretation at all times by the attending physician*. And some information is discouraged by Medic-Alert. For instance drug dosages which change constantly. Similarly the presence of blood antibodies is never detailed but simply indicated by engraving the directive: crossmatch vital.

### WHY MEDIC-ALERT IS INVALUABLE.

Some of the warning information if ignored will, at best, prolong treatment at considerable pain to the patient and loss of beds to the hospital. But often information ignored can be fatal. For example: several thousand Canadians have bracelets that warn of malignant hyperthermia. General anesthetics and muscle relaxants are death to them. Many Canadians have negative blood. The damage from a substitute in a life and death emergency could be irreversible. Contact lenses, if left in an unconscious victim's eyes, will chew the corneas within hours and could mean blindness if neglected. A scuba diver jailed as a drunk can die without immediate professional treatment for the bends. Be assured that Medic-Alert's only function is to aid treatment with prior knowledge when patients can't speak for themselves. □

\*Reg. T.M.

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# Workmen's Compensation in Nova Scotia

Thomas E. Dobson,\* M.D.,

Halifax, N.S.

The Workmen's Compensation Act in Nova Scotia was born of necessity and was a direct result of the rise of the factory system, which had brought about a marked increase in the number of accidents leading too often to serious injury or death.

In the eighteenth century the principle of vicarious liability had developed, which meant that a master was vicariously responsible for acts done by negligent servants while acting within the course of employment, and thus the injured person could sue the common master. To establish a lawsuit, however, various elements had to be proven which on the other hand could be readily disputed by the employer. This of course led to a situation that could be quite costly to either party, particularly if the employee lost in court or if a substantial award was won against the employer. It also became apparent that in many instances, the employee would not win in court and this brought about a reduction in the number of lawsuits, although accidents and injuries continued to rise.

It was clear that proper and just legislation was needed to correct the situation and, in the late eighteenth hundreds and early nineteenth hundreds, various unsatisfactory acts were attempted. The first Workmen's Compensation Act was passed in England in 1897 and in the United States in 1902 (declared unconstitutional until 1917). In Canada the first act was passed in Ontario in 1914, while the second act was passed in Nova Scotia in 1915 and became operational on January 1, 1917.

The basic principal of The Workmen's Compensation Act is that of a mutual industrial insurance scheme. This provides financial benefits for workmen unable to work resulting from industrial illness or injury, and the funds are provided entirely by the employers. By the same token, the employer is absolved of any legal responsibility and cannot be sued by the employees. *The Act indicates clearly that entitlement to full compensation is basically for those totally unable to work in the general labour market and not any one particular occupation.* Misunderstanding of this intent by employees and their advocates has often led to confusion and sometimes animosity against the Board.

Since the Act was proclaimed in 1915, many amendments have occurred which in part were necessitated by social change and in other instances due to an ever increasing knowledge in the field of occupational medicine. Many diseases have now been accepted as occupational in origin and this also is true with certain disorders of the musculo-skeletal system. Changes in benefits have also occurred fairly regularly since the Act was passed and, at present, the maximum weekly rate based on previous yearly earnings of \$12,000 or more is \$173.08. This represents seventy-five percent of the compensable maximum earnings and is income tax free. Claimants are also covered for all medical

costs in relation to their compensable conditions and, in certain instances, travelling expenses, etc. There are also provisions in the Act for other benefits such as widow's pension, children's pension, helpless allowance, etc.

At present, this province has a unique appeal system in the Act which is not duplicated in any other province. Prior to the late 1950's there was no form of appeal for dissatisfied claimants to follow, other than to reapproach the Board. At that time legislation was passed establishing the medical review board system. This consisted of three independent doctors, with one being a specialist in the field of the claimant's particular medical problem. These boards were appointed from time to time by the Minister of Labour who, after reviewing all the evidence on file, felt there was sufficient doubt requiring a further medical review. This system operated until 1975, when the government repealed it and made provisions for a government-appointed Workmen's Compensation Appeal Board, which operates separately from the Workmen's Compensation Board and consists of lay individuals. Since the appeal board system has come into effect, the number of claims heard by this appeal system has risen dramatically, with a corresponding increase in awards plus administrative costs. In 1973 and 1974 under the medical review board system, the total costs of awards plus administration was \$245,710 and \$326,714 respectively, whereas in 1976 and 1977 under the present appeal board system total costs were \$778,955. and \$868,736.

The Workmen's Compensation Act is administered by a board which is government-appointed and at present consists of a Chairman, Vice-Chairman and three Commissioners. All final decisions regarding compensation and the Act are made by the board, although they are continually advised and assisted by the various departments within the board's structure. The number of claims fluctuates and at present averages approximately 30,000 per year — about 5,000 more than ten years ago. In reference to medical costs it is interesting to note that in 1977 the total costs for medical treatment was \$3,559,487, whereas in 1968 it was \$1,382,334. These figures represent a significantly higher percentage increase than the number of claims.

The main function of Medical Department of the Board is to oversee all medical aspects of claims and to advise the Board regarding anything of a medical nature. This includes reviewing medical reports, physical examinations of claimants, review of submitted medical accounts and input to the Rehabilitation and Accident Prevention Departments as required. As with any medical insurance system, the Board relies heavily on medical reports, and the efficient and fair processing of claims cannot be carried out when reports are incomplete or non-objective. Although in many instances physicians find themselves in the position of the claimant's advocate, this should not hinder them from keeping their

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Continued on page 59.

# The Industrial Accident Victim

## THE VICISSITUDES OF COMPENSABLE INJURIES

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The purpose of this paper is an attempt to bring to the attention of the Nova Scotia medical profession some of the emotional and existential problems of industrial accident victims before, during and after an injury.

My experiences as Psychiatric Consultant to the Workmen's Compensation Board (W.C.B.) of Nova Scotia and other provinces, have persuaded me that psychiatric considerations in the evaluation of the industrial accident victim are essential for the diagnosis and management of his injury, as well as for the patient himself.

The population covered under the Workmen's Compensation Act consists mainly of blue-collar workers between the ages of their late teens to their retirement period, and the majority are males. However, in my work with industrial accident victims, I found that the age group requiring psychiatric consultation covers a narrower age segment.

Most of the patients referred to me by the W.C.B., or directly by their own physician, had been suffering from the consequences of their injury for longer than six weeks. Although only the more obviously "functional" problems accompanying industrial injuries have come to my attention, many of the emotional difficulties and social problems I was able to elicit in the histories of industrial accident victims can be extrapolated and applied to many workers who have been injured at their job, especially to those whose recovery has a prolonged course. The latter assumption is strongly supported by the increased literature on this subject.

The present-day wage earner, immersed in a society which exposes him to a multitude of stresses in and outside of his employment situation, has become more insecure and apprehensive in social, economic, financial and domestic affairs. If, in addition to these general personal concerns, more critical personal and interpersonal difficulties such as an increase in the worker's family responsibilities and financial pressures, become unbearable to him, his ability to keep his mind on his job will be jeopardized. His preoccupation regarding his job security, his financial obligations and other personal matters frequently take precedence over his job performance. Such worries about his existential difficulties grow even more at the time the worker has reached the end of the hierarchical line at his place of work and/or the "limits of his incompetence".

Under the pressures of realistic concerns or exaggerated interpretation of his reality situation, mental conflicts occur which, in turn, lead to symptoms of anxiety and depression. In a more detailed inquiry about the accident victim's pre-accidental experiences, one can frequently elicit information about events such as death in the family or of friends, family strife, accidents in others close to the patient, etc. Physical and mental complaints as, for instance, excessive

fatigue, insomnia, pains in different locations of the body, impotency, etc., can be encountered in the pre-accidental histories. Recent studies in California indicate that rotating shiftwork exacts a heavy toll from workers, including accidents. The series of psychological events which pre-date the accident, as well as the emotional phenomena accompanying the accident and its sequellae, have been summed up by a number of authors as "accident process" "accident syndrome" and "post-traumatic neurosis".

The preceding paragraphs, emphasizing the possibility of psychological preconditions to accidents, should not lead to the conclusion that *all* accidents are emotionally determined. A great many accidents are "Acts of God" in which emotional or personality problems do not play a causative role. The etiology of most industrial accidents falls most probably between such "Acts of God" and injuries caused solely by circumstances relating to the victim's personality.

While the number of accident claims reaching the W.C.B. fluctuated only between 25 to 30,000 within the last ten years, the disbursement for compensation, medical aid and pensions has risen between 1973-1977 from about 13 to 21 million dollars. The latter statistical data has been cited in order to demonstrate the rapidly increasing expenses the W.C.B. has been faced with in recent years. This inflationary trend has put progressively more pressure on the contributors to and the administrators of the W.C.B. The medical staff of this agency is consequently also affected by these pressures, and cannot help but be influenced in their decision-making by financial considerations. It would not be surprising if such considerations would not eventually filter down to the benefactors of this insurance scheme, and would colour the injured worker's relations with the medical staff of the Board and possibly with other physicians as well.

Because no financial compensation is provided for patients under the N.S. Medical Insurance Plan, the administration of patient care and the patient-physician interaction appears to be less disturbed by third person intervention than the medical management of W.C.B. patients. In comparison between these two modes of medical care, the treating physician's bias leans more towards the care of non-compensable conditions. However, I am sure the patient who has been injured at his job will receive the same treatment and his relationship with his physician will follow the same traditional pattern as if his condition had occurred outside of his employment.

Nevertheless, two subtle factors enter the picture which may alter the injured worker's initial relationship with his physician — one affecting the accident victim, and the other his doctor. The worker who has encountered an accident at work and who, by his injury, is forced to absent himself from his work for an indeterminate period, is not only concerned now about the symptoms and discomforts resulting from his

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injury, but also begins, sooner or later, to contemplate his job security, his present and future responsibilities, as well as his right to adequate monetary compensation while out of work.

On the other hand, his physician is aware, not only of his responsibility to his patients, but also to the W.C.B., and at times to the patient's employer. His first task is the immediate care of the injured worker, however, he is also faced with the obligation to report his findings and the patient's progress to the W.C.B. and sometimes also to the worker's employer. This means more "paperwork", and this does not find much favour from most physicians.

Most industrial injuries respond to the prevailing treatment methods in a predictable manner. The accident victim's condition improves, he recovers and returns to his job. The course of his recovery process proceeds as in non-compensable injuries of comparable nature.

However, complications of diverse etiologies can greatly interfere with the treatment, rehabilitation and eventual recovery of the accident victim and may even lead to transient or permanent invalidism. These consist of undiagnosed or intervening physical pathology or of chronic complaints about symptoms and discomforts, for which no physical etiology or explanation can be detected. Intractable pains, persistent fatigue, excessive restrictions of movements, hypo- or hypersensitivity of some part of the body are only some of the examples of such complaints. Subtle or more obvious psychopathology — usually symptoms of anxiety or depression — can also jeopardize the expected course of treatment and rehabilitation of the injured worker.

Industrial accidents take place not only in areas of high physical activity such as construction sites, mines, etc., but can also occur during the simple performance of a routine job. It is remarkable how frequently minor accidents cause severe and sometimes chronic post-accidental handicaps of all sorts. Slipping, minor falls, twisting of the spine, and negligible bruises are all modes of accidents which are not infrequently reported as the original causes of incapacitating conditions. It is interesting to note, at this point, that the definite and persistent complaints may not become manifest until hours, or even days, following the accident. As mentioned before, the setting, the circumstances, as well as personality factors of the accident victim himself, are not only significant as contributing causes to the accident, but also in determining to a degree the development and the course of the post-accidental condition.

Two small vignettes, taken from the histories of accident victims, will depict the circumstances preceding or accompanying relative minor accidents, the nature of the resulting injuries and the patient's short and long-term response to them.

### CASE 1

S.B., a 40-year old truck driver acquired a back injury while lifting a barrel from his vehicle. He finished his shift, in spite of some pains in his lower back, but the following day he was unable to get up from his bed. He was a muscular, healthy looking man, who had a good medical history and a satisfactory work record.

Physical investigation did not reveal either fractures or typical symptoms and signs of intervertebral disc protrusion. In spite of thorough investigations and prolonged treatment, this worker has still not been able to assume permanent

gainful employment. This man's accident occurred more than ten years ago.

In my inquiry I was able to elicit the following information. Not long before his accident he had lost his newly built, but unnoted, house by fire. In order to increase his wages he suggested to his employer that he would like to perform his work without a helper, if this would mean an improvement of his income. His employer agreed with this proposition, and it was not long after that he had the accident.

### CASE 2

A.S., a construction foreman in his mid-forties, helped one of his workers to lift a heavy board from ground level to a window about 8 feet above. The worker slipped, loosened his grip on the board, which glided down and pulled the foreman's shoulder momentarily backwards. The latter developed a sudden pain in his right shoulder, which was mingled with intense fear about having permanently damaged it. At that moment he also was aware of his great annoyance at the negligent worker, and being a foreman, thought that he had "no business" to help this man "in the first place". This injury, which again was not accompanied by serious physical pathology, resulted in a very prolonged recovery period.

There is no doubt that both of these injured men consulted their physicians about their physical complaints and the consequences of their accidents, and were treated accordingly. The "hidden agenda" — poor judgment and a number of emotional conflicts preceding and accompanying their accidents had receded into the background of their minds in the face of their physical complaints.

On many occasions the question arose in my mind whether more detailed histories on the initial or subsequent contacts with accident victims regarding the accident situation, would provide more information about the significance of the accident, as well as the injured person himself. I also wondered whether such inquiry would not only give the accident victim an opportunity to ventilate his prevailing emotions, thus relieving some of this anxiety and also reducing his uncertainty regarding the nature and severity of his injury. Such an exercise may be beneficial during the first aid situation and may also influence the entire "accident process" in a positive manner.

This beneficial effect of permitting the accident victim to talk about his emotional and existential problems which existed before and at the time of the accident was demonstrated to me when I interviewed such patients, even months and years after their original injuries. I found that they not only could remember detailed circumstances surrounding the time of their accident, but that they were also eager to talk about them.

Injuries are usually accompanied by pains and considerable discomfort. Physically, and at times even more psychologically, the patient is rendered incapacitated to a major or minor degree. The more immature, anxious and depressed he is, and the more serious his injuries are, the more helpless he becomes after an accident. Under the stress of the emergency the injured person not only requests effective treatment for the injury itself, but also seeks understanding, succorance and emotional support; that is, he wants to be taken care of.

If the patient's passive, dependent needs are frustrated by being ignored during and shortly after the accident, he may try to attract attention to himself by overemphasizing his physical symptoms, and his complaints become magnified. This kind of mental mechanism fosters resistance to treatment, delays the recovery process and has a tendency to mar the doctor-patient relationship.

Problems described in the preceding paragraph and some of the intervening complications during the "accident process" create frequently a treatment situation which can become progressively more frustrating for the patient, as well as for the physician(s).

The patient's impatience with his slow recovery and the doctor's irritation with his lack of success in his efforts, jeopardize the entire therapeutic process. The patient begins to project blame in all directions, on his physician, the W.C.B., other authorities and frequently also on his own family. He feels neglected, ignored, poorly treated and generally thinks that he is being "pushed around". The physician, at this point, is tempted either to ascribe the patient's excessive and chronic complaints to a "functional overlay", or to refer him to another colleague.

In two papers on "Low Back Pain in Men Receiving Workmen's Compensation" and in a personal discussion, Dr. A. W. M. White, a former orthopaedic consultant to the W.C.B. of Ontario, mentioned that his study of 700 patients observed and assessed by him twice yearly, indicated that those patients with low back pains, who are disabled longer than 6 weeks, tend to have chronic complaints. His conclusion seems to apply to other cases of industrial injuries as well.

Several years ago I tried to establish the fate of those patients registered with the W.C.B., whose return to work was delayed beyond 6 weeks, in order to corroborate or otherwise, the connection between slow recovery and chronic complaints. At the same time I attempted to estimate the magnitude of this problem in terms of cost and therapeutic difficulties. Unfortunately, this research failed on account of unavailable, appropriate data.

The histories of most of those W.C.B. patients I have seen indicate that at one stage of their prolonged "accident process", accident victims appear to go through a "critical period". It seems to coincide with the increased preoccupation about job security, financial problems, concern about his and his family's future and the patient's correct or imagined impression that everybody is withdrawing from him.

The patient responds to the circumstances surrounding this "critical period" with more persistent and insistent complaints. Emotional problems become more prominent and in his visits with his doctor he harps even more on his symptoms than before. An inquiry about the patient's emotional difficulties and his present life situation, which may possibly clear the air, fails because the patient's intensified physical complaints overshadow all other issues. Thus the psycho-social aspect of the situation is ignored, both by the patient and the physician. The latter becomes increasingly more puzzled by the discrepancy between the magnitude and diversity of the patient's complaints and scarcity of his physical findings.

Charged with disappointment, discouragement and hostility, the relationship between accident victim and his physician

deteriorates even further. The physician's self-esteem suffers as he is confronted with a very "unsuccessful" patient, and the patient, dissatisfied with the treatment he is receiving, presses for more investigations and "different" modes of treatment. He even consents to undergo any kind of operation "which would help".

Ambiguous medical reports reaching the W.C.B. frequently indicate the treating physician's dilemma and induce the medical staff of the Board to review the patient's eligibility for compensation and to recommend clarification of the patient's condition by one or more specialists. In many cases this procedure had already been pursued, frequently with unsatisfactory results. In the latter case it may be deemed indicated to call upon a psychiatric opinion.

Many injured workmen who came to my attention had reached an "advanced stage" of their "accident process". The psychiatric referrals or physicians' reports describe such patients' conditions as "functional"; they speak about psychological overlay" and rarely mention "malingering".

I have seen very few malingerers, and the emotional features of the "accident process" characterized as "psychological overlay" or "functional disorder" I have always viewed as part and parcel of the total morbidity picture as presented by the accident victim, and as such deserved appropriate treatment as the other phenomena of the "accident syndrome".

It is true that many symptoms and complaints of such patients fall within the realm of psychopathology. However, most of these emotional phenomena — singularly or in syndromes — defy any diagnostic attempt on the basis of the diagnostic outlines presented by psychiatric textbooks. The psychological aspects of pain sensations, the physical concomitants of anxiety and depression, body image distortions and hysteria-like symptoms can possibly be best explained as responses to faulty psycho-physiological adaptation. Many of them are signs of the decompensation of habitual psychological defence mechanism occurring under the stress of the accident and its consequences.

At this stage of the "accident process" months or years may have passed since the accidental injury, and new stressful variables are entering the picture. As in secondary infection following surgery, a different agent and other pathological phenomena than the original one become operative.

1. The patient's condition has changed his entire lifestyle. Inactivity, boredom, lack of contact with his past co-workers and friends and the inability to pursue his previous interests focus his attention now to his threatening invalidism.

2. Uncertainty regarding the continuation of his compensation payments — now the only income he has grown to depend on — becomes more worrisome, especially as his savings begin to dwindle and his debts to accumulate.

3. Intensification of physical investigations, renewed rehabilitative procedures or surgical interventions, the latter often performed far removed from his own home community, enhance his anxiety as his habitual mental defenses have become inoperative. His growing apprehension about his medical care, especially if the diverse procedures have not been properly explained to him, and if he had no opportunity to discuss his questions regarding the latter, increases his resistance to all prescribed treatment.

4. Pain, a common feature of the "accident syndrome", is puzzling at times, as far as its origin and mechanism is concerned, and frequently remains resistant to any kind of treatment.

5. Most accident victims eventually are put on some medication, be it for pains, insomnia, tension or other physical or psychological complaints. If the drugs taken by the patient are not strictly supervised — a difficult task — the indiscriminate intake of the same, whether in excessive amounts and/or in diverse combinations, can and frequently does, produce chronic and undesirable side effects. The latter lead occasionally to a confusing symptomatology, such as chronic fatigue, weakness, etc., which the patient may ascribe to the consequences of his injury.

6. While members of the patient's family catered to him for a long period after the accident and were very solicitous about him, they now begin to withdraw from him. This change in the family's attitude develops usually insidiously, as the patient's spouse and other relatives feel progressively more helpless to alleviate his discomfort and consequently his complaints. They also express more openly irritation about the patient's regressive behaviour patterns, such as periodic sulking, continuous demanding and child-like clinging on others. Thus family members detach themselves more and more psychologically from the patient. As others in the family have to supplement the income of their household by gainful employment, they have to leave the patient most of the day to his own devices. This makes him feel even more lonely, abandoned, and he bemoans his fate more than ever.

Before the accident he was the breadwinner, who participated very rarely in household duties. Now he has become responsible to keep the house clean and to provide meals for others. Thus his role in the family has changed as he assumes more feminine functions. This, in turn, does not enhance his already diminished self-esteem.

7. Contemplating the possibility of his return to work, if he should get well, he is faced with insurmountable difficulties. The residual sequelae from his accidental injury, his long "rest" and his psychological vulnerability to any kind of stress, threaten to reduce his efficiency in the case of his potential return to the old job. The resumption of his last position would also remove all his compensation payments and/or other financial support of which he or his family were recipients.

The question now must enter his mind, whether he really dares to assume again the responsibilities of his job or even to get well. Confronted with a condition resulting not only from an accidental injury, which in its prolonged course had been and still is complicated by the multiplicity of factors described, everybody involved — the accident victim himself, his family, his physician(s) and the W.C.B. — finally reach an irreversible impasse. The patient would like to extricate himself from the increasingly more upsetting, uncomfortable and frustrating relationship with both the doctors and the W.C.B..

The patient's family strives for the termination of ambiguity, uncertainty and constant turmoil in their household. Even at the price of a lower standard of living, the return to a semblance of stability and a more predictable existence is preferable to the prevailing confusion.

The physician(s) like to escape a progressively more unsatisfactory and irritating treatment situation, especially if

the latter included unsuccessful surgical interventions. "Operations of frustration" are occasionally performed on the insistence of the patient.

The W.C.B. would like to "finalize the case" and "close the patient's file", as treatment, communication with the patient's physician(s) and any progress of the "illness process" have come to a standstill.

The unsatisfactory solution "of the case" puts the individual accident victim in a rather peculiar position in relation to his family, the community, his physician(s) and the W.C.B. He still feels quite handicapped, unable to resume his former occupation. His family is still exposed to his complaints and either ignore them or more frequently, share his "rightful indignation", his feeling that he has been unjustly treated, and continue to commiserate with him. Eventually, some or all family members, support the accident victim's quasi-paranoid stance, blaming doctors and the W.C.B. for his misery. By now the patient's physician has more or less given up any attempt at further investigation, rehabilitative efforts and even treatment. The W.C.B. have stopped regular compensation payments and, if deemed indicated, granted, the accident victim a pension, the amount of which is usually lower than the amount he had received so far.

Throughout the course of his "accident process" the patient has moved psychologically from initial anxiety to depression, hostility and, at the stage of impasse, almost to a paranoid attitude. He, however, eventually accepts the "deficit solution" of his case in a passive, dependent manner. Before retreating completely he makes a last attempt to justify his condition of partial or complete invalidism and to "defend his right", and solicits help from all the sources available to him — friends, the union, the Legion, politicians and lawyers.

In the past the claimant's appeal went as far as the office of the Minister of Labour, who, according to the statutes, is responsible for the W.C.B. The Minister, in turn, referred the case to an independent Medical Review Board for re-evaluation and recommendations. In 1975 the Government of Nova Scotia repealed the provision of Medical Review Boards and established a W.C.B. Appeal Board to hear the cases of dissatisfied claimants.

The final failure to resolve the medical, psychological, social, financial and legal consequences of his industrial accident, causes the patient eventually to settle down to a reduced work and social status. He is now willing to accept the price for his handicap by lowering his and his family's standard of living, as well as his self-esteem. However, the benefit he derives from his invalidism is reduced responsibility, competition and social stresses.

The "accident process" has run its course. The accident victim's struggle for "proper treatment" and his compensation payments, are over. Demands on him have been greatly reduced and his "sick role" is now accepted by his family and society at large. The patient's family constellation has undergone considerable changes, but has reached a tolerable degree of stability. The patient's physician — there is now usually only one involved — has reduced his care to symptomatic treatment.

The W.C.B. has closed the case. If a pension has been granted, it is usually inadequate to provide for the patient and his family. Different levels of government are now called upon to lend a helping hand. Other members of the family,

too, have taken over some financial responsibilities. Thus, the total family income guarantees a degree of subsistence; however, out of necessity it has to be accepted by the family, which consequently has to adjust to it.

The accident victim's invalidism and the difficulties arising from it, can at times be the source of family strife, economic hardship, unhappiness and emotional conflicts. Family disruptions of all kinds require frequently intervention from public health authorities, welfare departments and other organizations. The prolonged "accident process" and its consequences is usually associated with tremendous costs in terms of suffering, frustration and monetary outlays.

## SUMMARY

My observations on industrial accident victims leads to the conclusion that psychosocial consideration in the medical and administrative management of most injured workers could have a beneficial effect on their treatment. It could shorten the course of the "accident process", it could avoid hardships for the patient and his family, it could improve communication between patient and his physician(s) and finally, it could save considerable amounts of money for the W.C.B. and the community.

In a previous paper on the "Psychosocial Aspects of Compensable Back Injuries" I have made a number of general recommendations, which are relevant to the content of this paper. □

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## WORKMEN'S COMPENSATION IN NOVA SCOTIA

*Continued from page 54.*

reports and correspondence as factual as possible. Physicians are also encouraged to contact the Board's medical staff by phone at any time they feel a particular situation requires special attention.

It is hoped that this summary of the Workmen's Compensation Act in our province will give physicians a better understanding of it and with this perhaps an improved relationship with the Board and its staff. □

## CANADIAN OCULAR ADVERSE DRUG REACTION REGISTRY

A National Registry for collecting and recording proven or suspected ocular and systemic adverse reactions to ophthalmic medications has been formed at the University of British Columbia. It is sponsored jointly by the Poison Control and Adverse Reaction Programs Division, Bureau of Epidemiology, Health & Welfare Canada and the Canadian Ophthalmological Society. Physicians are invited to contribute case reports to the Registry Committee. The letter should specify age and sex of the patient, suspected drug, route and daily dosage, nature and course of event, other drugs taken at the time, and an opinion as to cause and effect. Possible associations will be monitored and suggestions made for further study.

Send reports to:

Chairman, O.A.D.R. Registry Committee, Department of Ophthalmology, University of British Columbia, 2550 Willow Street, Vancouver, B.C. V5Z 3N9



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# Nongonococcal Urethritis:

## A POLYMICROBIAL SEXUALLY TRANSMITTED DISEASE

Patricia K. Dauphinee\*, B.Sc., and J. A. Embil\*\*, M.D., Ph.D., F.R.C.P.(C),

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Nongonococcal urethritis (NGU), a common, sexually transmitted disease in men, is a source of increasing concern to physicians and the public. In many parts of the world, this disease, which is also called nonspecific urethritis or postgonococcal urethritis (PGU), is the most frequently recorded sexually transmitted disease. In Great Britain, for example, the annual number of cases increased by nearly 500% from 1951 to 1971.<sup>1,2</sup> (NGU is a notifiable disease in Britain.)

The incidence of nongonococcal (nonspecific) genital infection in women is difficult to determine since the syndrome is often so nondistinctive that a definite diagnosis is impossible.

The term NGU is applied to a form of urethritis which is not gonococcal in origin. Various microorganisms appear to be involved in the disease, including *Chlamydia trachomatis*, T-strain mycoplasmas (*Ureaplasma urealyticum*), *Mycoplasma hominis*, *Trichomonas vaginalis*, *Candida albicans* and *Herpesvirus hominis* Type 2. Some of these microbes are considered oculo-genital since they can cause eye disease following ocular contamination with infective genital discharge.

The concept of NGU and related oculo-genital infections is not a new one — ophthalmia neonatorum was well known in early Greek and Roman times.<sup>3</sup> In the early 1900's, it was noted that the eye of the newborn could be infected by a disease in the birth canal due to nongonococcal genital infection or gonococcal infection (GC).<sup>3</sup> Adult follicular (inclusion) conjunctivitis was also found to be associated with infections of the genital tract,<sup>3,4</sup> including NGU.

Until the 1960's, research concerning the control and prevention of chlamydiae (formerly called bedsoniae) was frustrated by technical limitations.<sup>4</sup> However, in 1965, a revolutionary tissue-culture procedure described by Gordon and Quan<sup>5</sup> opened up a new pathway for the research of chlamydiae and the diseases they cause.

More recently, controlled studies of NGU have been carried out using serologic techniques as well as isolation results. Present concern centres around the high incidence of isolation of *C. trachomatis* and the genital mycoplasmas (*U. urealyticum* and *M. hominis*) associated with NGU; other bacterial, fungal and viral components are also being studied for their etiologic role in this infection.

### ETIOLOGY

Major etiologic agents of NGU are considered to be *C. trachomatis* and *U. urealyticum*; no single cause has been established. NGU appears to be sexually transmitted and indirect transmission (e.g. through soiled bath towels) has been suggested.<sup>6</sup> Genital-to-eye infection may also occur either directly or indirectly from some NGU hosts. Transmission has been reported in unchlorinated swimming pools,<sup>3</sup> albeit a group activity other than swimming may have been responsible.

Experimental evidence for the etiological role of chlamydial infections in NGU is increasing. The chlamydiae are intracellular parasites, dependent on the host cell for ATP. They have a cell wall similar to that of bacteria, multiply by binary fission and contain their own DNA and RNA. The genus is typified by the inclusions it forms in host cytoplasm. Its two species, *C. trachomatis* and *Chlamydia psittaci*, share a group antigen. *C. psittaci* is a human disease carried by birds (not involved in NGU); *C. trachomatis* is deemed responsible for trachoma,<sup>7</sup> inclusion conjunctivitis,<sup>3</sup> neonatal pneumonitis,<sup>8</sup> lymphogranuloma venereum infections<sup>9</sup> and many cases of NGU.<sup>7</sup> Although *C. trachomatis* is responsible for two forms of eye disease, only inclusion conjunctivitis is dependent upon a genitourinary reservoir; trachoma is transmitted eye-to-eye in certain endemic areas.<sup>7</sup> *C. trachomatis* is typified by its iodine-staining inclusion bodies in host cytoplasm and its sensitivity to sulfonamides.

Recent studies have shown a higher incidence (30-50%) of *C. trachomatis* in male patients with NGU than in control subjects (about 7%).<sup>10-14</sup> Microimmunofluorescent testing for chlamydial antibody and sulfisoxazole therapy have shown that *C. trachomatis* is pathogenic in the urethra<sup>15,16</sup> and causes NGU in some patients, particularly those with a first episode of NGU.<sup>10,14</sup> Sexual transmission of chlamydial infection has been substantiated;<sup>10</sup> in one study, *C. trachomatis* was isolated from the endocervix of respective female partners of most NGU cases that were chlamydia-positive. (Identical serotypes for these couples were found in 85% of cases in which both samples were typed by microimmunofluorescence.)

Recovery of *C. trachomatis* from a small percentage of control subjects seems to indicate that asymptomatic infection exists in some persons. (All control subjects were as sexually active as other subjects in this study.)<sup>10</sup> It appears that this phenomenon (found in both men and women) results from host defense mechanisms that restrict the organism to low population levels.

Genital mycoplasmas have also been considered seriously for their role in NGU.<sup>17</sup> They are pleomorphic microorganisms with morphology and metabolic requirements that resemble bacteria and cell-wall deficient bacterial variants.

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They have a triple layer cell membrane and are apparently resistant to penicillin due to the lack of a cell wall.

Two strains of mycoplasma are thought to be involved with NGU: *U. urealyticum* and *M. hominis*. However, isolation of mycoplasmas has shown that both *U. urealyticum* and *M. hominis* are present in men with and without urethritis. Some studies have reported greater colonization, especially of *U. urealyticum*, in men who did not have urethritis;<sup>10,11</sup> yet, a number of patients showing symptoms of NGU have only harboured *U. urealyticum* in their urethras.<sup>17,18</sup> It has been suggested that *U. urealyticum* produces urethritis in only some individuals and in most is carried chronically and asymptotically depending on host environments.<sup>14</sup>

Nevertheless, *U. urealyticum* should still be considered for its involvement in nonchlamydial NGU. In studies based on quantitative cultures and chemotherapy and those in which chlamydia-positive NGU patients were excluded, ureaplasmas were isolated significantly more often than in asymptomatic persons, particularly when first episodes were considered.<sup>14,19</sup>

Direct examination of urethral fluid shows a specific pathogen such as *T. vaginalis* or *C. albicans* in less than 5% of cases.<sup>20</sup> *T. vaginalis*, a protozoan parasite, and *C. albicans*, an intermediary form between the dermatophytes and the fungi, are also causes of vaginitis.

Some cases of NGU seem to be due to *H. hominis* Type 2,<sup>10</sup> but the incidence of these is low; the most common site of infection is cervical tissue.<sup>3</sup>

Isolations of anaerobic and aerobic bacteria and cytomegalovirus in relation to NGU seem inconclusive.<sup>15</sup> Anaerobes appear to be normal commensal organisms in the urethra.<sup>15,19</sup>

Evidence suggests that *C. trachomatis*, which is definitely an oculogenital pathogen,<sup>3</sup> is responsible for most cases of NGU. However, about 50% of NGU cases appear to have no specific cause. Thus, as an apparent microbial mosaic, NGU presents a complex problem to physicians and society.

## SYMPTOMS

NGU patients usually complain of pain on voiding and may experience urinary frequency. The urethral meatus usually becomes dull and purple. Dysuria may vary in degree and may be present continuously or intermittently for days or weeks. Exudate is usually apparent, especially before initial urination in the morning; in some cases there is crusting and staining of underwear. The exudate may be scanty, watery and mucoid, and the first few drops of urine contain flecks of pus cells, a condition known as pyuria. It is important to note that discharge and dysuria may present separately or together. *C. trachomatis* infection is more often associated with discharge than with dysuria, whereas, NGU associated with *U. urealyticum* is typified by dysuria but not discharge.<sup>13</sup> Asymptomatic NGU has been reported but even in these cases pyuria is usually present.<sup>10</sup> Severe genital itching may also occur.

In women, nongonococcal genital infection may result in dysuria, cervical bleeding, vaginal itching and discharge. More often, however, infection goes unnoticed since the symptoms are usually mild. Attempts to link cyclic changes in the menstrual cycle<sup>21</sup> or use of oral contraceptives<sup>9</sup> with increased incidence of genital infection have been inconclu-

sive. However, it has been noted that about 80% of pregnant women may be positive for genital mycoplasmas.<sup>22</sup>

Various complications can arise from NGU although in some cases the exact causal relationship is difficult to establish. Patients with NGU may present with eye infections such as conjunctivitis.<sup>7</sup> This is usually attributed to genital chlamydial infection which has been transmitted to the eye. The infection is usually benign with signs of pannus and mucopurulent exudate, but in severe cases conjunctival scarring may result.

Reiter's syndrome, which is typified by nonspecific urethritis, mucocutaneous lesions, nonsuppurative polyarthritides and conjunctivitis, is now considered to occur after sexual exposure in about 2% of NGU cases.<sup>23</sup> Reiter's syndrome may be recurrent; although the organism responsible for the disorder has not been determined, Chlamydia has been implicated.<sup>24</sup>

Stricture of the urethra<sup>20</sup> may be associated with some NGU infection. Inflammation of the prostate may also be involved;<sup>20</sup> this may become chronic and, consequently, infect the seminal vesicles. Acute "idiopathic" epididymitis is a frequent complication of *C. trachomatis* NGU infection as well.<sup>25</sup> In some cases, sterility has been attributed to these complications.

Since the etiologic agents of NGU may manifest themselves in the female genital tract, it is important to evaluate the complications arising from nongonococcal genital infection. Chlamydia is commonly involved with acute salpingitis.<sup>26</sup> Genital mycoplasmas in pregnant women have been blamed for spontaneous abortion, stillbirth and low birthweight.<sup>8,22</sup> Infertility may result from both salpingitis and genital mycoplasma infection.<sup>8,26</sup> Furthermore, *H. hominis* has been implicated as a cause of carcinoma of the cervix.<sup>27</sup>

## DIAGNOSIS AND TREATMENT

Some patients with NGU present with symptoms that result from psychological factors (i.e. guilt or anxiety) rather than infection; this possibility should be considered in all cases.

Since the cause of NGU is elusive, diagnosis must be by a process of exclusion.<sup>9</sup> Although the symptoms of NGU and GC differ in most cases, it is possible in others to mistake one infection for the other. This possibility must be considered before prescribing penicillin for untested gonococcal infection, since penicillin is not effective in treating NGU. Thus it is important to determine whether or not GC is present by using a Gram's stain of urethral exudate. (Urethral smears and "first-catch" urine may also be stained and examined: early morning examination is preferred.) If intracellular gram-negative diplococci are present, the patient has gonococcal infection. If extracellular gram-negative diplococci are found, the exudate should also be cultured on medium selective for *Neisseria gonorrhoeae*.<sup>20</sup>

When Gram's-stained exudate is examined, cells should also be noted, since the presence of moderate or numerous polymorphonuclear leukocytes indicates urethritis. If possible, culturing for chlamydiae should be done (generally using cell cultures sensitized by radiation or an anti-metabolite.)

Patients with urethritis who are GC-negative should be treated for NGU with tetracycline 250 mg orally 4 times/day for 14 or 21 days.<sup>9</sup> An 80% initial cure rate can also be achieved with 500 mg orally 4 times/day for seven days.<sup>20</sup>

Since tetracycline is also effective against GC, therapy need not be delayed if culture results for causative organisms are indicated. In the event of allergy to tetracycline, erythromycin at 250 mg orally 4 times/day for 21 days should be prescribed.<sup>9</sup> (Erythromycin is somewhat less effective than tetracycline.<sup>20</sup>) Both tetracyclines and erythromycin are useful in combatting Chlamydia - and/or *U. urealyticum*-positive NGU. Spectinomycin is relatively effective against *U. urealyticum* and a combination of sulfonamides and aminocyclitol is effective therapy for chlamydiae.<sup>28</sup>

Furthermore, it is important that sexual partners be treated at the same time as their respective consorts. Ideally, they should be tested for GC and given the same dosage of tetracycline or erythromycin as their respective partners. Abstinence from sexual intercourse should be urged during treatment, since reinfection seems to occur almost spontaneously; however, rubber condoms may be used. It may also be advisable for the patient to wash his underwear in boiling water each day and not share his towels or washcloths.

A follow-up examination is necessary two and/or four weeks after treatment. If the infection persists, re-treatment or urologic evaluation should be carried out. Persistent infection not only discomforts the host, but also contributes to a growing reservoir of nongonococcal infection due to its contagious properties.

## EPIDEMIOLOGY

Since the epidemiology of NGU varies with the environment, no precise pattern has been found for this infection. In some studies NGU has been found more often in white patients than in black, whereas, gonococcal infection seems to be more common in black patients.<sup>10 14 27 29 30</sup> Furthermore, NGU is more common among university students and people who hold managerial positions, have higher educations, are in higher socioeconomic groups and have private physicians; in contrast, GC is more common in unskilled workers, people at lower socioeconomic levels and those with no private physician.<sup>10 27</sup> These findings suggest a parallel between lower socioeconomic class in which there is less use of health care facilities and GC rather than a racial variable in resistance to certain types of microorganisms. Jacobs and Kraus<sup>30</sup> showed a tendency for more circumcised black men to develop NGU than noncircumcised black men. This pattern may also apply to white patients. It has been suggested that circumcision affects susceptibility to certain infections by changing the normal flora of the urethra.<sup>30</sup>

Since NGU is usually transmitted sexually the incidence of the disease is directly related to the number of sexual partners. The mean age of first intercourse for the NGU group is significantly higher than that for the GC group, and the total number of sexual partners is usually greater for those who have gonococcal infection.<sup>10</sup> It has been suggested that the use of the rubber condom significantly reduces the incidence of NGU.

Most patients (about 66%) with NGU are single and usually within the 16 to 30 year age group (with peak occurrence at about 25 years of age).<sup>27</sup> Similar findings have been reported in patients with GC.

Since sexually active females may harbour infections

associated with NGU without having obvious symptoms, they may be naive carriers of potential NGU infection. This may explain the apparent latency of NGU in men, and therefore the seemingly high incidence of recurrence.

It is also necessary to realize that symptoms of NGU often occur after penicillin-treated GC infection. This is categorized as PGU and results from residual populations of chlamydiae, mycoplasmas, etc. which were harboured during the GC infection and were not affected by the penicillin treatment. Thus, individuals with GC may be considered "high risk" for non-specific urethritis in the form of PGU.

## CONCLUSION

Nongonococcal urethritis has reached epidemic proportions; its incidence is at least comparable to gonococcal infection and the sequelae may be just as severe. Therefore, treatment must be implemented to cure the individual, prevent reinfection and eradicate the reservoir of NGU from every community.

Fortunately NGU is easily cured with tetracycline therapy. However, if the problem is to be eliminated, further study of the etiology and epidemiology of the infection is needed to achieve a more specific management of persistent or recurrent NGU. □

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# A Comparison of Hearing Screening Procedures in Pre-School Nursery Children

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The main objectives of any school hearing screening program are: 1) to identify auditory disorders which could have serious consequences if undetected and untreated; 2) to identify hearing abnormalities of a lesser severity that would have adverse effects if untreated, such as middle ear effusion<sup>1</sup>. According to the National Conference on Identification Audiometry<sup>2</sup>:

*"The goal is to locate children who have even minimal hearing problems so that they may be referred for medical treatment of any active ear condition discovered to be present and so that remedial educational procedures can be instituted at the earliest possible date."*

Traditionally, pure tone audiometry has been routinely performed in mass screening programs to detect hearing loss. While audiometric screening has proven valuable in the determination of moderate to profound hearing loss, serious questions have been raised as to its sensitivity in detecting mild to moderate conductive pathological conditions (those which deal with the transmission of sound by the middle ear system).

Recent studies<sup>3,5</sup> have indicated that up to 64 percent of conductive pathological conditions may go undetected by audiometric screening. Furthermore, when comparing the results obtained from audiometric and otoscopic screening, the pure tone method has been shown to be 50 percent less efficient in the identification of middle ear effusion<sup>3</sup>.

Grosso and Repp<sup>6</sup> have suggested three factors which contribute to the inability of audiometric pure tone screening to identify mild middle ear abnormalities: 1) the recommended hearing screening levels are not sensitive enough to detect mild hearing loss; 2) ambient noise levels eliminate the possibility of reducing screening levels; and 3) the reliability of the child's responses to pure tones are questionable.

## IMPEDANCE AUDIOMETRY

Recently, the introduction of impedance audiometry has provided an objective method of measuring middle ear function as an alternative to pure tone testing. The impedance test battery consists of tympanometry and the acoustic reflex. Tympanometry measures the compliance (stiffness) characteristics of the middle ear system by artificially altering the air pressure within the external auditory canal. With the use of a strip chart recorder or an X-Y plotter

coupled to the impedance meter, a graphic display is recorded for permanent record. Figure 1 illustrates a series of tympanometric configurations. Note that any variance from a normal bell-shaped curve at 0 mm H<sub>2</sub>O is indicative of an abnormal middle ear function.

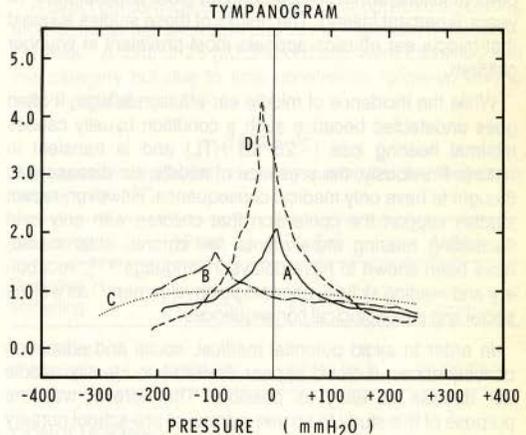


FIGURE 1

Tympanometric curves illustrating normal and pathological middle ear conditions: A) Normal; B) Mild retraction; C) Non-complaint middle ear function; D) Hypermobile middle ear system.

The second impedance measurement is the contraction of the stapedial muscle to acoustic stimuli. The acoustic reflex occurs at loud intensity levels and is a bilateral phenomenon. That is, the introduction of a loud sound to one ear will reflexively contract both stapedial muscles. In a normal ear, elicitation of the acoustic reflex occurs at approximately 80 to 90 dB hearing threshold level (HTL). Clinically, the presence or absence of the reflex offers significant diagnostic information as to the site-of-lesion and degree of hearing loss. For example, the acoustic reflex will not contract in the presence of a mild conductive pathological condition.

Since the rapid development of impedance audiometry, its clinical use has been strongly advocated as routine procedure in mass school screening programs<sup>1,7</sup>. Numerous investigations<sup>8-12</sup> have demonstrated impedance audiometry to be a superior screening technique when compared to pure tone audiometry in the detection of conductive abnormalities. As evidence, Brooks<sup>13</sup> reported that impedance screening identified middle ear pathology in 14 percent of cases passed by audiometry. McCandless and Thomas<sup>10</sup> in a comparative study of impedance, pure tone, and otoscopic screening reported that impedance was 2.8 times more efficient than audiometry. Finally, impedance screening has shown a better than 90 percent efficiency in the identification of conductive pathology<sup>11,14</sup>.

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## MIDDLE EAR EFFUSION

The incidence of conductive impairments in school aged children appears to be greater than formerly considered. Estimates range between 5 percent<sup>15</sup> and 23 percent<sup>16</sup> and as high as 29 percent in children from lower socioeconomic areas<sup>4</sup>. There seems little doubt that the development of impedance equipment has provided greater accuracy in the identification of middle ear effusion and has brought its incidence to a more realistic figure. In addition, there also appears to be a susceptibility factor associated with age. Jerger and his colleagues<sup>17</sup> have reported a higher incidence of middle ear abnormalities in a group of six year old children with decreasing incidence by age twelve. McCandless and Thomas<sup>10</sup> also suggest a higher occurrence of impedance and otoscopic failure in younger children (3-5 years, 20 percent failure) when compared to an older population (9-15 years, 9 percent failure). The results of these studies suggest that middle ear effusion appears most prevalent in younger children.

While the incidence of middle ear effusion is high, it often goes undetected because such a condition usually causes minimal hearing loss (<25 dB HTL) and is transient in nature. Previously, the presence of middle ear disease was thought to have only medical consequence. However, recent studies support the contention that children with only mild fluctuating hearing impairments (ie. chronic otitis media) have been shown to have delays in language<sup>18,19</sup>, vocabulary and reading skills<sup>20</sup>, phonologic development<sup>21</sup> as well as social and psychological consequences<sup>7</sup>.

In order to avoid potential medical, social and education consequences, it would appear desirable to identify middle ear disease as early as possible. Therefore, it was the purpose of this study to screen a group of pre-school nursery children to determine the incidence of detectable middle ear abnormalities. Specifically, a comparison of audiometric and impedance techniques were used in order to determine the most accurate and efficient screening procedure in the identification of middle ear disease.

## METHODS

### Subjects

A total of 127 pre-school nursery children ranging in age from 2<sup>1</sup>/<sub>2</sub> to 5<sup>1</sup>/<sub>2</sub> years old were tested. All children were enrolled in a pre-school program located in Halifax, and testing was conducted at respective nursery schools. Parental consent forms explaining the screening procedures and the basis for pass/fail criteria were sent home with each child. Because of the age of the children used in this study, play audiometry utilizing a modified conditioning/reinforcement technique was adopted.

### Equipment

A Beltone Audiometer (Model 10D) was used in the pure tone screening procedure. Each child was tested at 25 dB HTL at frequencies 500, 1000, 2000, and 4000 Hz bilaterally. The audiometer was calibrated on a daily basis meeting ANSI 3.6 — 1969<sup>22</sup> specification for frequency, intensity, and linearity attenuation.

Impedance screening was accomplished using a Madsen Z073 impedance audiometer. Daily calibration was completed according to the manufacturer's specifications. Acoustic impedance measures included tympanometry and the presence or absence of the acoustic reflex.

### Pass/Fail Criteria

The inability to respond correctly at 25 dB HTL to any frequency in either ear was criteria for pure tone screening failure.

The criteria for impedance screening consisted of a modification of suggested guidelines by the American Speech and Hearing Association<sup>23</sup>. The guidelines are based on tympanometry and acoustic reflex measurements. Tympanograms were visually monitored between +100 mm H<sub>2</sub>O and -300 mm H<sub>2</sub>O pressure or beyond, if no curve peak was seen. The acoustic reflex was elicited using a 1000 Hz pure tone at 100 dB HTL contralaterally.

TABLE I

Impedance screening criteria. Suggested guidelines for acoustic impedance screening of middle ear function (Asha: 7, 1978).

Classification	Screening Pass/Fail Criteria Results of Initial Screen	Disposition
1. PASS	ME pressure normal (+50 mm H <sub>2</sub> O) Mildly positive/negative (+50 to +100 mm H <sub>2</sub> O) (-50 to -200 mm H <sub>2</sub> O) Acoustic reflex present	Cleared, no return
2. AT RISK	ME pressure abnormal A/R present or A/R absent, ME pressure Normal or mildly abnormal (peak pressure outside the ranges described in Classification 1).	Retest 3-5 weeks A) if tympanometry and A/R fall into Classification 1: Pass b) If tympanometry or A/R remain in Classification 2: Fail and Refer
3. FAIL	ME pressure abnormal and A/R absent	Refer

For screening, tympanometric curve peak pressure and the presence or absence of the acoustic reflex were the only factors considered in referral criteria. Table I presents the middle ear screening criteria used in this study.

## RESULTS AND DISCUSSION

### Pure Tone Results

Table II shows the number and percentages of children by age who passed and failed the audiometric pure tone screening. In the youngest age group (2-6/3-5), 53.7 percent of all children tested failed the pure tone task. This percentage is more than twice (21.4%) the percentage of failures seen in the oldest group tested, revealing an inverse relationship between age and failure criteria. That is, as age increases, failure rates decrease. Three major factors may have contributed to this observation: 1) the middle ear abnormalities appear to be more prevalent in the younger age group; 2) it was felt in many cases that the younger groups were unable to condition and/or accurately respond to the pure tone task; and 3) because pure tone screening was accomplished in non-ideal locations, ambient noise levels introduced masking effects which should be taken into consideration in the audiometric screening results. Collectively, all three factors contribute to the inability of pure tone screening procedures to accurately assess the condition of the middle ear system.

TABLE II

Results of Audiometric pure tone screening by age category (N=127).

Age	Number of Subjects	Pass	Fail
2-6/3-5	41	19 (46.3%)	22 (53.7%)
3-6/4-5	44	29 (65.9%)	15 (34.1%)
4-6/5-6	42	33 (78.6%)	9 (21.4%)

### Impedance Results

The results of impedance screening by age may be found in Table III. The first alarming observation is that within the youngest group (2-6/3-5), 65.8 percent of all children tested failed suggesting guidelines established for this study. Specifically, tympanograms which had a peak pressure in excess of -200 mm H<sub>2</sub>O pressure 2nd the absence of an acoustic reflex. By the time children were between 4-6/5-6, the failure rate had declined to a predictable 19.0 percent. Results of impedance screening suggest a reduction in middle ear disease as age increased. In the youngest age group, only 12.1 percent (5) of all children tested (41) passed

TABLE III

Results of impedance screening by age category (N=127).

Age	Number of Subjects	Pass	Fail	At Risk
2-6/3-5	41	5 (12.1%)	27 (65.8%)	9 (21.9%)
3-6/4-5	44	18 (40.9%)	17 (38.6%)	9 (20.4%)
4-6/5-4	42	26 (61.9%)	8 (19.0%)	8 (19.0%)

the impedance screening protocol. In the middle age category (3-6/4-5), 40.9 percent (18) of all children tested (44) passed. Finally, in the 4-6/5-6 age group 61.9 percent (26) of the children (42) had normal middle ear function.

Table IV provides a comparison of the overall pass/fail results measured by audiometric and impedance screening. Of the total number of children tested (127), only 49 (38.6%) passed impedance screening, while 81 (63.6%) passed the pure tone task. Unquestionably, the results of this study clearly indicate the inability of the pure tone audiometric testing protocol to detect the presence of mild middle ear abnormalities. Conversely, impedance screening which has proven to have a better than 90 percent agreement with otoscopy<sup>10</sup> appears to have excellent efficiency in the identification of conductive pathology, ie. middle ear effusion.

A direct percentage of pass/fail criteria between screening techniques is not allowable due to the impedance category, "At Risk". A total of 26 (20.5%) children were classified into this category but due to time constraints, follow-up testing was impossible.

TABLE IV

A comparison of pass/fail criteria for audiometric and impedance screening (N=127).

Screening	Pass	Fail	At Risk
Pure tone screening	81 (63.8%)	46 (36.2%)	—
Impedance screening	49 (38.6%)	52 (40.9%)	26 (20.5%)

## CONCLUSIONS

The present study was designed to compare two screening procedures in a group of pre-school nursery children. To summarize, it may be stated: 1) that audiometric pure tone screening is an inefficient method of detecting middle ear abnormalities; 2) that a considerably higher rate of pure tone failure was observed in the youngest age category; 3) that middle ear effusion is age related showing a decrease in failure as age increases; 4) that impedance screening using tympanometry and the acoustic reflex provide a sensitive measure for detecting middle ear effusion; and 5) that an alarming 40.9 percent of all children tested failed impedance screening.

A critical review of impedance screening audiometry will show that criticism is directed not at the methodology but at that criteria for referral. The transient nature of middle ear effusion has made this an issue of major importance. If every child who failed the impedance screening were referred to a physician for examination, a large number of cases would recover by the time the child was seen. Careful observation, monitoring and further audiological testing may be one solution in alleviating frustration.

Another important facet of this study was the fact that the majority of children presented no complaints and appeared subjectively symptom free. If the identification of middle ear effusion is to be accomplished in a hearing screening school program, then the implementation of impedance is mandatory. Only then can we be assured that mild middle ear disease will be detected and potential educational consequences avoided. □



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## “Not the dog’s fault”

Paul E. Kinsman\*, M.D., C.M.,  
*Wolfville, N.S.*

A case of diarrhoea in a 2½ month old baby, Sarah S., born August 11, 1978. This 2½ month baby, with no previous abnormal history, was seen at home in the evening two days prior to admission to the hospital. She was suffering from low grade fever and frequent watery stools, and examination did not explain the cause of her illness.

The baby was examined again the following morning. The general findings were negative except for low grade fever up to 38°. The parents stopped feeding solids to the infant, but continued “Similac” formula. She was eating well but was irritable with apparent crampy abdominal pain.

By the following morning, she was having 5-6 yellow watery stools and her temperature was up to 39°C. Referral for paediatric consultation was arranged to the Izaak Walton Killam Hospital for Sick Children. On examination in Emergency, the baby was described as irritable, feverish (temperature 39.7° her pulse was 140, the mouth moist, but showed no tears. The skin turgor was normal, the fontanelle was soft, the neck supple and the remainder of the examination normal.

The infant was observed at the IWK and although her temperature subsided, the watery stools persisted and she was admitted to the hospital. Stool cultures revealed *Salmonella* Group 8, and she was treated immediately with Ampicillin. One blood culture was obtained positive for *Salmonella* Group B. (S. *Heidelberg*).

Progress: The infant improved and was discharged on November 9, 1978, to continue on Amoxicillin at home. Although she improved, Sarah’s stool cultures remained positive for *Salmonella Heidelberg* on November 22, 1978, but subsequently have been negative.

Investigation: The parents’ stools were negative for *Salmonella*. Sarah’s father often walked with the family Great Dane, who frequently tore apart the carcasses of chickens from a neighbouring chicken farm. The dog’s stool was cultured positive for *Salmonella Heidelberg* and she was treated with Ampicillin by the veterinarian. The veterinarian commented “It is rare that a *Salmonella* infection can be demonstrated in the gastrointestinal tract of dog.” The local Department of Health has since investigated and it is understood that the chicken farmer will be requested to dispose of chicken carcasses by some safer method in future. The family is now aware of the potential hazard a pet can be to an infant.

This case demonstrates the community health aspects of disease prevention that involves family physician, family and the community. □

\*Family Physician, P.O. Box 390, Wolfville, N.S. B0P 1X0.

## To the Editor:

I shouldn’t have to write this note. Canadians are suffering and even dying because a doctor or nurse ignores the Medic-Alert warning bracelet or necklace they wear. Almost daily I receive such news. We have a quarter million bracelet wearers in Canada, most on their doctors’ recommendation, and people are joining 200 a day. Coroner’s juries have cited us for over 5 years now.

A staff of 12 is highly trained to process member medical problems and update the records. Medic-Alert is not the joke some doctors treat it. Some progressive hospitals include an M-A question on admitting forms.

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Please give this message some space in your publication from time to time. Call or write for more information. Your co-operation will help.

Yours truly,

A. Larry Stevenson,  
 Treasurer

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## NEW MEMBERS

The Physicians listed below have joined The Medical Society of Nova Scotia between December 1, 1978 and April 30, 1979. A most cordial welcome is extended by the Society.

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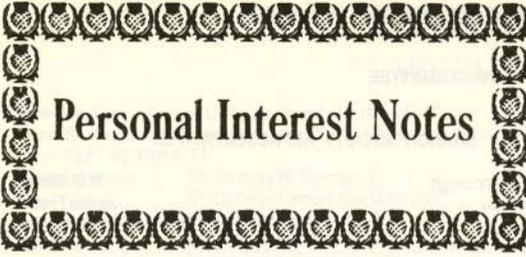
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# Personal Interest Notes

**Dr. Tom Acker**, a pioneer orthopaedic surgeon now retired and living in Halifax, was recently presented with the Paul Harris Fellow Award by the Halifax Rotary Club. With his brother, Jack, he assisted thousands of crippled children in clinics around the Maritimes. At one period, he had 29 clinics in operation at the same time, travelling by boat and rail to Newfoundland, Prince Edward Island and all around Nova Scotia, at a time when poliomyelitis and tuberculosis were rampant. Many people will remember these two earlier orthopaedic surgeons whose work spanned half a century.

**Dr. R. O. Jones** has been named representative to the World Psychiatric Association.

**Dr. J. O. Hyman** has recently been inducted as a Fellow of the American Academy of Orthopaedic Surgeons.

**Dr. J. Embil**, a paediatrician, has become a member of the Board of Directors of the Canadian Society for Tropical Medicine and International Health.

Seven Nova Scotians have received grants from the National Cancer Institute of Canada. **Drs. S. T. Ghose** and **A. H. Blair** received \$22,000 for their work on cytotoxic agents and radionuclides in the diagnosis and treatment of cancer. **Drs. G. R. Langley, L. Fernandez, and J. M. MacSween** have received \$36,000 for their work on chronic lymphocytic leukemia. **Dr. R. Singer** will continue research on cyclic regulation with a grant of \$18,000. **Dr. I. A. MacDonald** received a grant of \$36,000 for his the investigation concerning bile acids and formation of mutagens by fecal bacteria.

A grant of almost half a million dollars for the next five years has been provided for research into the cure and prevention of serious infectious diseases in children. **Dr. K. R. Rozee**, head of Microbiology Department, recently explained the urgent need for more trained specialists and technicians in this field.

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MEDICAL SOCIETY INSURANCE PROGRAM.

**Dr. William M. MacRae** (48) of Halifax, died April 7, 1979 in the Victoria General Hospital. He graduated in 1955 from Dalhousie Medical School. At the time of his death he was co-ordinator of Emergency Services and Clinical Head of the Emergency Department of the Victoria General Hospital. He will be greatly missed by the medical community and community in general.

**Dr. James A. Langille** (70) of Amherst, N.S., died April, 10, 1979 in Florida. He graduated from Dalhousie University in 1932, and had his practice in Amherst. He was elected to the Provincial Legislature in 1953 and served 18 consecutive years as Progressive Conservative M.L.A. for Cumberland East. He was the Deputy Speaker of the N.S. Legislature from 1966 to 1970. Our sympathy is extended to his wife and family. □

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