

Auger injuries in children

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A 6-year review of auger injuries in Manitoba children revealed that 23 children sustained major injuries resulting in amputation of 17 limbs. Auger injuries are the main cause of traumatic amputation in children in Manitoba. Improved safety education for the entire farm family as well as better design of safety shields would decrease this carnage.

Une revue des blessures par outils à vrille chez les enfants du Manitoba au cours d'une période de 6 ans a révélé que 23 enfants ont subi des blessures majeures entraînant l'amputation de 17 membres. Les blessures par outils à vrille sont la principale cause des amputations traumatiques chez les enfants du Manitoba. Une amélioration des règles de sécurité pour la famille terrienne, de même qu'une meilleure conception des écrans protecteurs devraient faire diminuer ce carnage.

In Manitoba, grain auger and power take-off injuries are the most common types of farm accidents resulting in amputation. In North America they account for 50% of all deaths from machinery accidents, although farmers account for only 7% of the population.¹ Although in Manitoba one eighth of the total number of persons employed work on the 35 000 farms in the province, these people have the highest rates of injury and death.

Unfortunately there have been few Canadian studies of this problem and none of farm accidents in children. In a major review of farm accidents in Saskatchewan it was revealed that of all farm accidents resulting in death or hospitalization over 50% involved children under 16 years of age.² A review of cases of traumatic amputation in children seen at the Child Amputee Clinic in Winnipeg revealed that auger injuries were responsible for nearly 50% of all instances of traumatic amputation of children's limbs in Manitoba. The frequency and magnitude of this type of trauma are far greater than the well known thalidomide congenital limb amputations, though publicity about this fact has been almost negligible.¹

The purpose of this review is to emphasize the role of augers in producing loss of limbs in children and to study methods of preventing such injuries in the children of farm workers.

The auger

Archimedes designed the first auger to deliver water up a hill by encasing a screw device within a cylinder. The principles of today's augers are the same except that the power has increased from that of a single ox to that of a modern tractor. Portable grain augers, the most common form used by farmers on the Prairies, vary in diameter up to 120 cm and have a speed of 500 to 600 r/min; they are powered by an electric motor, a gas engine or a tractor power take-off³ (Fig. 1). The intake of the auger must of necessity be accessible to the grain. The grain may be fed to it from a hopper, or the lower end may simply be buried within a pile of grain, thus being hidden, so that a child investigating a moving pile of grain may not comprehend the potential hazard. Augers are not easily stalled, even when a limb becomes caught in the device.

Although a tremendously labour-saving device for the farmer, the auger is one of the most hazardous pieces of farm equipment. In the few reviews available on trauma due to farm ma-

chinery the tractor has been mentioned as the main cause of agricultural accidents and the auger as the second most common cause.³⁻⁷

Injuries in children

A review of the medical records at the Children's Centre and the Rehabilitation Centre for Children in Winnipeg revealed a total of 23 children, only 2 of whom were girls, that required hospitalization for grain auger injuries in the years 1969 through 1974. The average age at the time of injury was 7 years, but most of the children were less than 7 years old.

Traumatic amputation, often at a high level, was the most common type of injury: 17 limbs were amputated in 15 children (Fig. 2). Fractures and dislocations were the second most common form of trauma (Fig. 3). An average of 36 days in hospital was required for treatment of these wounds. There were no minor injuries; the trauma was always severe.

The peak incidence of the injuries was in the fall, when the auger is used most frequently on the Prairies: 75% of the children in this series sustained their injury during the fall harvesting season.

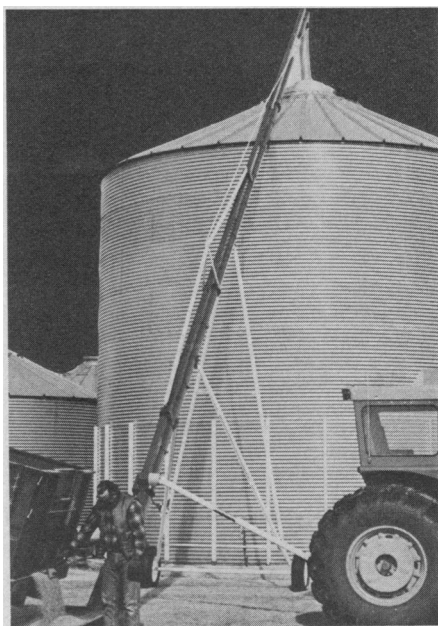


FIG. 1—Portable grain auger: dangerous but tremendously labour-saving piece of farm machinery.

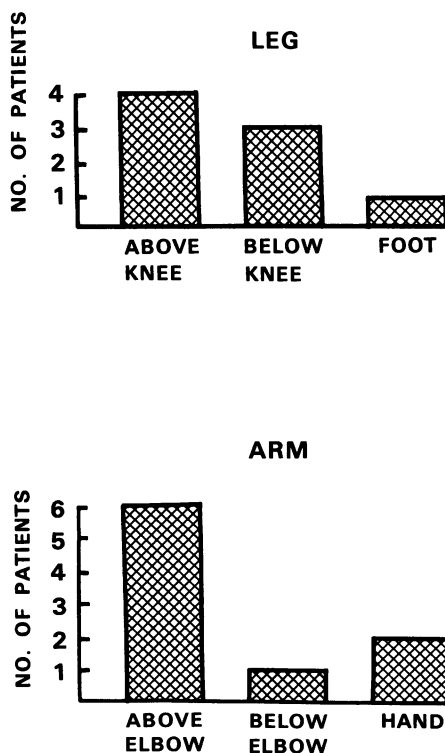


FIG. 2—Levels of amputation by auger in children.

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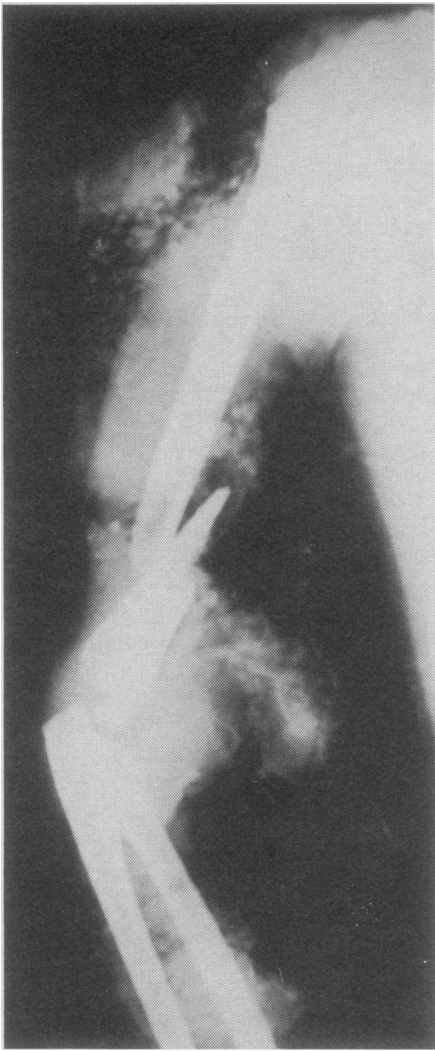


FIG. 3—Fracture of humerus by auger in 3-year-old boy. Scattered soft-tissue opacities caused by impacted grain.

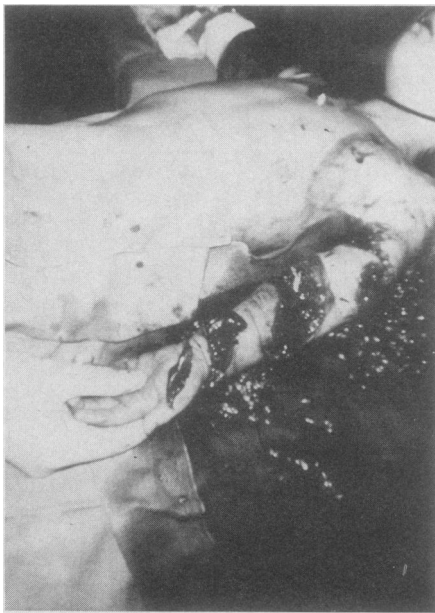


FIG. 4—Arm of 4-year-old boy after entanglement in auger; arm had to be amputated above elbow. Note lacerations of screw, one more revolution of which would have severed shoulder and neck.

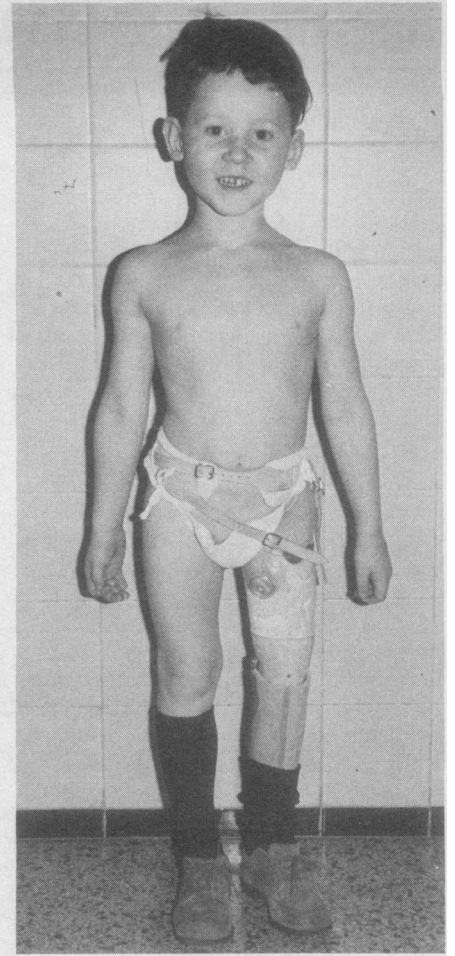
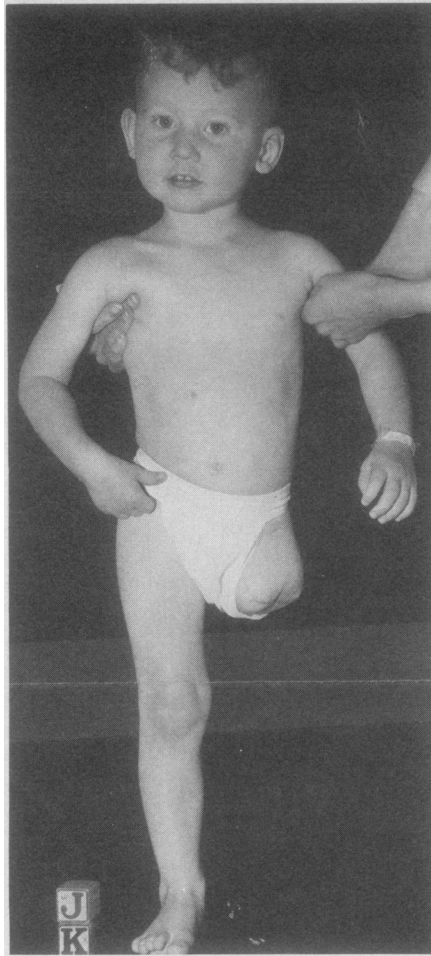


FIG. 5—High above-knee amputation and prosthesis in 5-year-old boy.

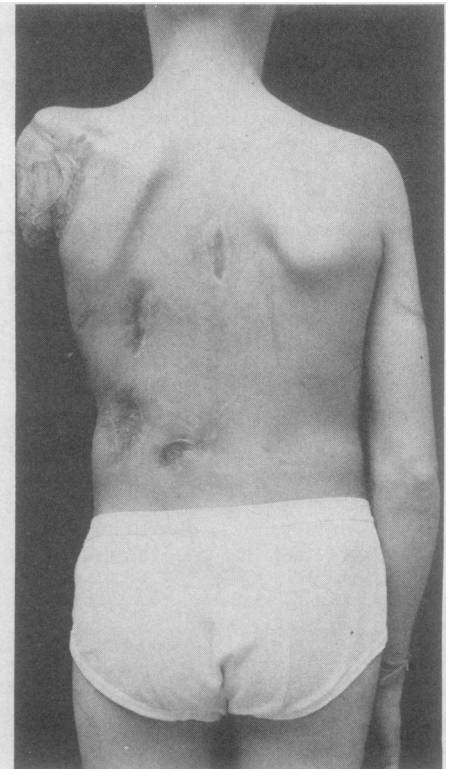
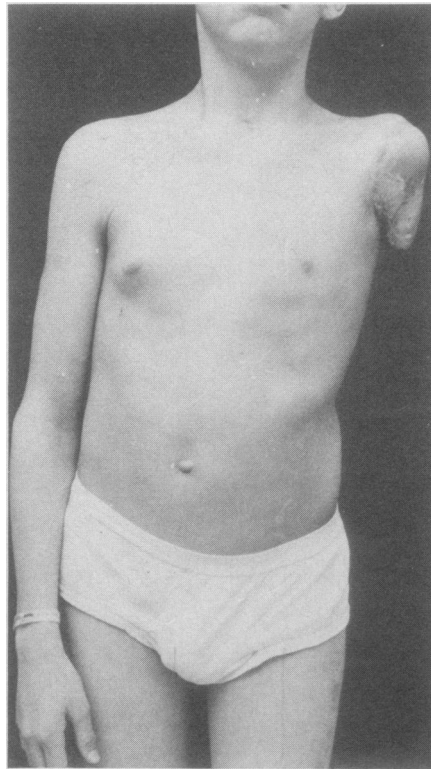


FIG. 6—Severe scarring often encountered in healed auger injuries causes difficulties in prosthetic fitting.

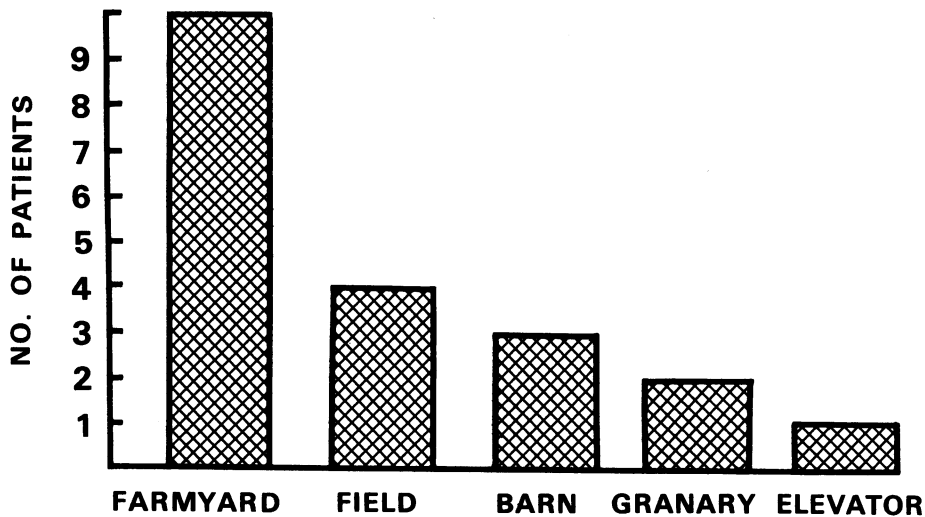


FIG. 7—Locale of auger accidents.

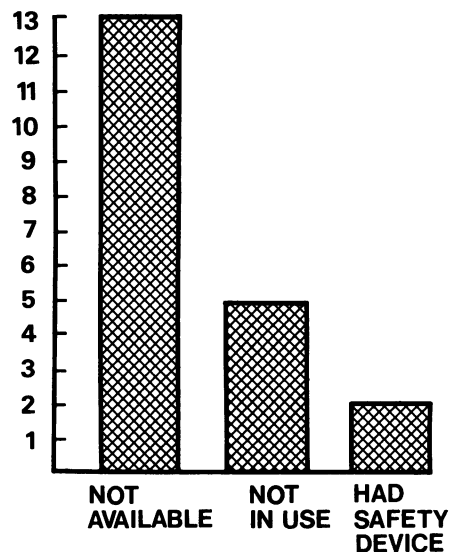


FIG. 8—Data on auger safety devices.

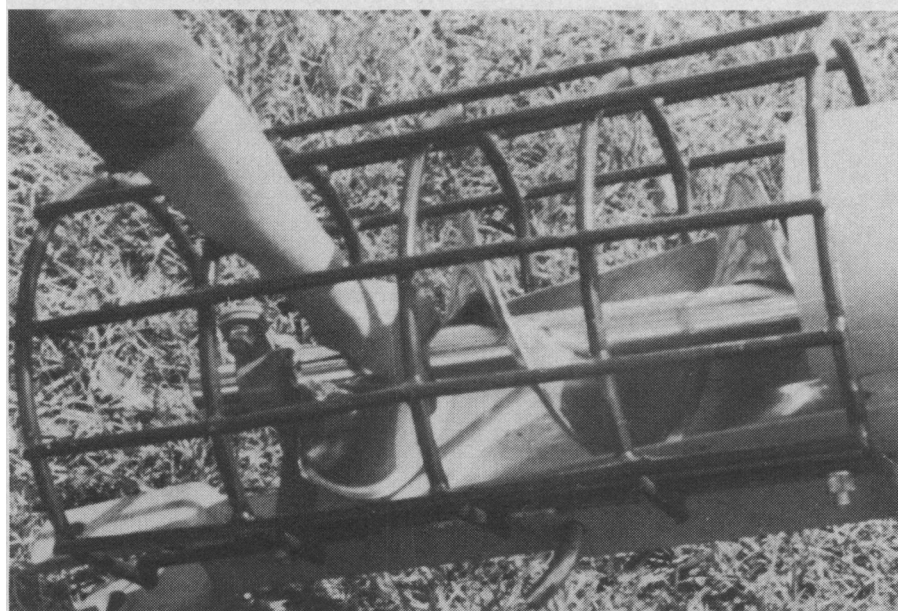
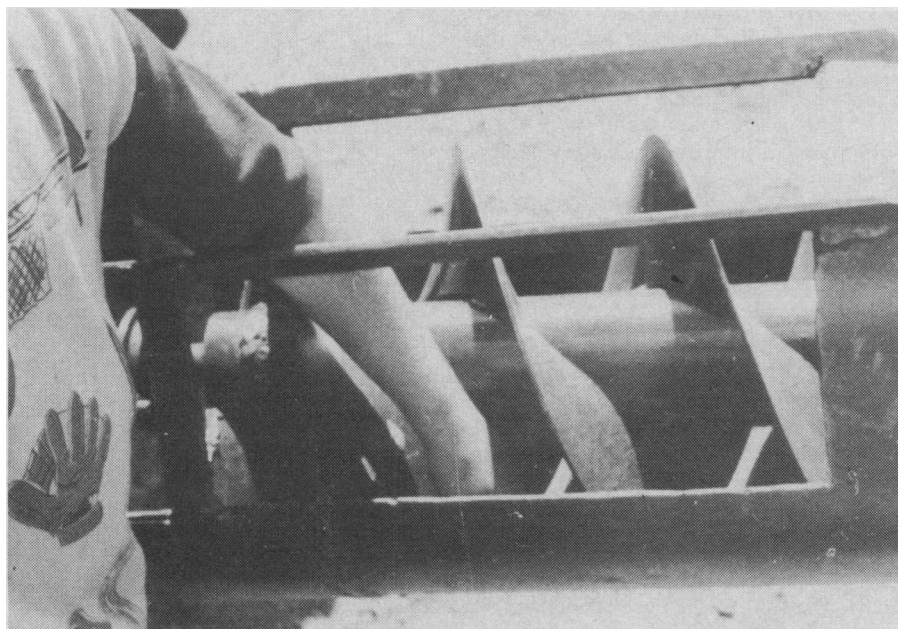


FIG. 9—Protective shields currently available for augers.

The high level of amputation in most of the children was particularly disconcerting and easily explained by a screw mechanism capable of producing a speed of 600 to 800 r/min at about full tractor power. The limb literally becomes screwed into the machine within seconds, with disastrous and sometimes fatal consequences⁸ (Fig. 4). Subsequent prosthetic fitting may be most difficult because of the high level of amputation (Fig. 5). Two children lost both an arm and a leg. The severe scarring resulting in further problems with prosthetic fitting is illustrated in Fig. 6.

Most auger injuries occurred within the confines of the farm yard (Fig. 7). The child usually was playing in the vicinity of the equipment and in only five instances was he actually assisting with its operation. Most of the injuries took place in southern Manitoba; six (30%) occurred in Hutterite colonies.

Most of the children were receiving medical treatment within 1 hour of injury. None of the wounds were closed primarily. Significant infection occurred in only three patients and in none was it clostridial. The contamination of such wounds is horrendous; hence the closing of them is seldom a temptation to the surgeon.

What has been a temptation, however, is the replacement of completely degloved skin. This almost always results in complete skin sloughing. If the skin has not been damaged excessively but is completely degloved, the surgeon must take time to defat the skin and reapply it to a clean bed as a full-thickness graft.

In summary, the surgical management of an auger injury of an extremity is as follows:

1. The debris must be completely removed.
2. The wound must be left open.

3. The bone must be reduced and held by skeletal traction.

4. The skin if degloved must be replaced as a full-thickness graft.

Prevention

To gain better insight into conditions at the time of injury, we sent a questionnaire to all families whose child had been injured by an auger. Since most of the children were being assessed regularly at the amputee clinic the return rate was 96%. Enquiry about safety shields revealed that only seven of the augers possessed any type of shielding and this was seldom in use (Fig. 8), the main reason being that such a shield slows the flow of grain. One parent stated that in one auger the flow was slowed by 60%, so the shield was removed since at harvest time maximum efficiency of the auger is required.

In most industrial situations great strides have been made in eliminating or reducing occupational hazards, largely through regulations that are enforced by employers, unions and government agencies. Such regulatory mechanisms, however, are not operative in the case of the farmer, whose safety precautions are self-imposed and who is free to operate with or without them as he chooses, usually with meagre instruction.⁸⁻¹³ Safety shielding for power take-off shafts, cutting blades and augers are optional accessories in Canada and, because of their costs and the real or imagined decrease in efficiency of the auger, are usually not obtained by farmers. Not so in the United States, Britain and Australia, where farm equipment manufacturers are under more stringent regulations to provide safe equipment for the user.²

There is a need for more research in safety engineering and design for farm equipment. Protective devices currently available are inadequate for preventing an extremity from becoming entangled (Fig. 9).

Proper control of auger injuries in children lies in preventive rather than therapeutic measures. However, once prevention has failed, the initial management of such major injuries rests not in the hands of the emergency team of specialists at a modern hospital, but with one of the child's relatives out in the field, at some distance from the nearest medical aid. For this reason as well as the overall high rate of farm accidents it is essential that all farmers and their families take courses in first aid. At present such courses are few and in most areas nonexistent. The typical farm in Canada is still a family operation; hence all members of the family, including children, should receive adequate safety and first aid

instruction.

The declining numbers of general practitioners who live in rural areas, coupled with the modern area-centred clinic approach, make today's farmer, unlike the industrial worker, far removed from medical assistance.

Recommendations

The military medical services have demonstrated well the importance of locating the injured, conducting the appropriate evacuation and providing back-up services to reduce the mortality from major wounds. It is time we provided a similar service to the farm battlefield. As physicians we can encourage farm groups and governments to do the following:

1. Determine the true incidence of trauma secondary to accidents with farm equipment.

2. Provide better safety education for not only the farmer but also the entire family since the average farm is a family operation.

3. Encourage manufacturers of farm equipment to improve the safety design of their machinery.

4. Develop rural first aid programs.

5. Encourage realistic rehabilitation programs for the injured farm member so that the farm operation may continue.

Individually we as surgeons can do little but try to save life and limb, but collectively, each in our own area, we may be able to influence farm groups, manufacturers and perhaps even government to make attempts to reduce the incidence and severity of auger injuries.

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