A history of pelvic and acetabular fractures.

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Pelvic and acetabular fractures
Past, present, and future

Introduction  This article is a written summary of the Marvin Tile 2006 Lecture given by Martin Bircher. The Marvin Tile Lecture is given at the University of Toronto Pelvic and Acetabular Fracture course to recognize Marvin Tile for his outstanding contributions to orthopedic surgical teaching and in particular his commitments to pelvic and acetabular fracture treatment. In 1987, Mr Bircher was a Marvin Tile fellow when his passion for trauma management and treatment of pelvic and acetabular injuries was ignited. Mr Bircher returned to London, England, where he put his passion into action, becoming one of the most respected pelvic and acetabular fracture surgeons in the United Kingdom. This paper entitled “Pelvic and acetabular fractures—past, present, and future”, provides us with an overview of where we have come from so as to aid in planning for the future.

The past  In ancient China and Egypt there is abundant evidence for the treatment of orthopedic injuries including fractures of the pelvis. Mummified bodies have been found with overlapping of the pubic symphysis [1]. These may have been caused by some unpleasant injury, perhaps crushed by large stones being used to construct pyramids. However it is more likely that these deformities were caused by the process of mummification and bandaging itself. Perhaps overzealous pelvic sheeting!

In India, surgery was developing with instruments devised to release ligaments, and traction apparatus to reduce dislocations of the hip. In Ancient Greece there are descriptions of wounds about the pelvis being caused by arrows, and pelvic and acetabular fractures being caused by heavy stones.

Hippocrates actually classified hip dislocation [2]. He described inward, outward, backward, and forward dislocations of the head of the femur in relation to the pelvis. He devised strategies for relocation, emphasizing the importance of a different technique for each different type of dislocation.

Around the time of the birth of Christ, anatomy became of great interest. Accident surgery had also become very important. Avicenna (980–1087 AD) produced many texts in Arabic describing anatomical structures and he again emphasized the underlying principles of fracture treatment outlined by Hippocrates [3].

In 1066, William the Conqueror arrived in England and defeated King Harold at the Battle of Hastings. William was a warrior who had no interest in medicine and spent his years pacifying the unruly British. It is widely reported that William the Conqueror died of a ruptured testicle but I believe he actually died of the complications of a pelvic injury. Although a ruptured testicle would be acutely painful, it will not in itself lead to death. I believe the sequence of events were as follows: William’s wife became increasingly irritated by his enlarging frame. In 1087, she sent him to Rouen to go on a diet. On the way he was involved in a skirmish (he could not really resist a fight). In those days saddles had a very high pommel and as his horse stumbled he was thrown against the pommel...
and sustained a symphyseal separation. I often see these in modern day horse riders, particularly in North America where saddles are of a slightly different design than in Europe. This would account for his external injuries which I think were misinterpreted as a testicular rupture. I believe he sustained a symphyseal separation and injury to the genito-urinary tract, probably a urethral rupture. There would have been secondary contamination leading to septicemia and death.

During the Dark Ages, Europe saw very few advances in the specialty of orthopedics and in particular pelvic surgery. The modern specialty was really born with the publication of Malgaigne’s books on fractures and subluxations in 1847 [4]. At the same time in the United Kingdom, Sir Astley Cooper (1768–1841) described various pelvic fractures, making the distinction between marginal stable fractures and unstable pelvic ring injuries. At this stage it should be emphasized that all these observations were made on clinical grounds with no x-rays. For an acute diagnosis to be made there had to be obvious visible or palpable displacement of bones. This is why in Malgaigne’s books and atlas he only describes significantly displaced fractures and dislocations of the pelvis. There is some confusion with modern day surgeons about what precisely a Malgaigne fracture is. I believe if one studies his books closely, he is describing what is now known as bilateral sacral fracture or “jumper’s fracture”. These are the H-shaped double vertical shear fractures that people sustain when they fall or jump from a great height. There are usually sagittal transfemoral fractures of the sacrum accompanied by transverse connections with translocation of the sacrum and encroachment of the sacral canal. These injuries are usually complicated by neurological damage. Malgaigne describes these fractures associated with people jumping from buildings that were on fire. He also describes novel techniques for reduction of the fractures with the introduction of large wooden rods into the rectum. The wooden rod would reduce the translated sacral fractures into a better position. However, the technique was usually complicated by gross abdominal distension and he therefore went on to devise silver cylinders with cannulas to allow the escape of air. He records one patient being able to walk home after such treatment after twelve days despite “a little infection”! The modern specialty of acetabular surgery was yet to be born.

With the introduction of x-rays, the subspecialty advanced rapidly and different types of pelvic and acetabular fracture were identified. Albin Lambotte (1866–1955) produced stunning descriptions of techniques for fixing sacral fractures and described the use of sacral bars [5]. He was truly the master of all surgeries and significantly advanced the surgery of fracture management. In the UK in 1948, Sir Frank Holdsworth (1904–1969) produced his paper on dislocations and fracture dislocations of the pelvis [6]. He was a student at Cambridge and St George’s Hospital, Hyde Park. He undertook a number of junior positions at St George’s before becoming the first orthopedic specialist in Sheffield in 1937. His paper studied 50 patients and made key observations—including the dangers of death by bleeding and the complication of genitor-urinary injury. He concluded that sacral iliac dislocation was an evil injury with most patients suffering chronic permanent agonizing pain whereas patients with ilio-sacral fracture dislocations (crescent fractures) had a better overall outcome.

In the 1950s and 1960s, other than pelvic slings, the only surgical treatment recommended for unstable pelvic injuries were forms of external fixation. These became the gold standard treatment of such injuries. George Pennal (1913–1976) working in the University of Toronto Anatomy Department, began to identify subsets of pelvic fractures including lateral compression injuries, vertical shear forces, and open book type fractures. The study of the biomechanics led him to produce a classification which was later further modified by Tile.

Meanwhile in Paris in the late 1950s and 1960s, Robert Judet began attempting to treat displaced acetabular fractures surgically. He felt that the outcomes with displaced acetabular fractures following conservative treatment were unacceptable. He identified certain subsets of acetabular fractures that did not do well with conservative treatment. These included fractures that involved the tectum or roof and those fractures where the hip was unstable. He described ten classic fracture patterns (five basic and five complex). Judet also developed
many surgical approaches, particularly the ilio-inguinal ap-
roach, for treatment of anterior acetabular injuries. His work
was continued by his student Emile Letournel who diligently
collected data, listed complications, and educated a large
group of surgeons including Claude Martinbeau, Joel Matta,
Geoffrey Mast, Keith Mayo, and Eric Johnson. Other sur-
geons visited Paris regularly, including David Helfet and Roy
Moed. Meanwhile in Toronto, Marvin Tile continuing Pen-
nal’s work, published the classification of pelvic fractures in
the Journal of Bone & Joint Surgery (1986), and brought the
specialty together with his comprehensive book entitled
“Fractures of the Pelvis and Acetabulum”. There have now
With Tile’s teaching and the Sunnybrook fellowships, the
practice of pelvic and acetabular surgery has been advanced
and spread across the world. I was fortunate enough to be one
of his fellows in 1987. His books complement the equally bril-
liant text on fractures of the acetabulum produced by Emile
Letournel.

The present  Presently in the developed world, a full time job
as a trauma surgeon is not considered compatible with a good
lifestyle. The hours can be inconvenient and other subspecial-
ties within orthopedics pay much more handsomely. For pel-
vic and acetabular fracture surgery to provide the greatest
benefit to the injured patient in all countries, certain issues
need to be urgently addressed. By providing a good pelvic
fracture service the trauma system as a whole will benefit.
Trauma hospitals are struggling financially and this is at least
partly due to the unsophisticated coded systems that are used
to define activity and thus funding. For example, there are
over 17 different ICD10 codes for pelvic fractures and over 40
codes relevant to the pelvis in the OPCS system. Better coding
systems need to be developed in order to allow prompt pay-
ment for the treatment of trauma patients.

However, some units, particularly within the USA, are avoid-
ing treating uninsured trauma patients as they drain resour-
ces. This is known in the United States as ‘dumping’. These is-
ues are not only causing clinical problems but also have a
major detrimental effect on training.

An example of these inefficiencies was highlighted in the
United Kingdom in 2002. After a frustrating year of delays in
the definitive treatment of pelvic and acetabular patients I
went public with an audit that demonstrated that, within my
locality, it was 12 days between injury and a definitive surgery
for a pelvic and acetabular fracture. This audit led to a number
of meetings with healthcare providers resulting in the intro-
duction of a special tariff for definitive pelvic and acetabular
fracture reconstruction. It was felt that if there was a better
financing capability, the delay would be reduced. This in some
ways helped the situation as trauma units started receiving
more money for the treatment of pelvic fractures. However
other injuries eg, open fractures, are still poorly resourced
and the trauma units are still struggling. Unfortunately a sub-
sequent audit in my unit between June 2004 and June 2005
showed that the mean delay between injury and definitive
surgery still remains 12.6 days. The steady increase in local
trauma that remains underfunded has absorbed the extra re-
source earmarked for pelvic fractures. Other meetings are
going on in order to try and further rectify this problem. These
problems I believe are mirrored across Europe and North
America.

What are the solutions?  We must make trauma care attrac-
tive as a career to recruit young doctors, make sure they are
paid appropriately, and that they have good working condi-
tions. We need to apply political pressure and lobby our po-
itical masters.
There is some good news, certainly within the UK. We have over a dozen specialist pelvic units with fellowship trained surgeons. The new tariff will help to fund these units. Regular courses are run across the world and we recently completed another successful course in September 2006. The bad news is that these unacceptable delays remain and the pelvic story is somewhat deflected away from the fact that trauma systems are failing across the world. We are also being flooded with an increasing number of osteoporotic traumas associated with our ageing population.

We need to collect data. With this in mind, the European Pelvic Association of Surgeons (EPAS) has been formed. This will give us teeth. We also need to evolve better coding systems and continue educating ourselves, the public, and the politicians.

**The future** The immediate future of pelvic and acetabular surgery, in my opinion, should mainly focus on organizational changes. Systems need to be defined. Education needs to continue. Trauma, and particularly pelvic and acetabular surgery, needs to be brought to the forefront and inadequacies of our systems need to be highlighted to the politicians and the public. We should continue developing fine instruments and strive to develop new techniques to make the surgery of pelvic and acetabular fractures safer. With this in mind, computers will come to the forefront. Image guided surgery combined with sophisticated preoperative imaging will allow more focused treatment and less extensive incisions which are associated with a high complication rate. These advances, however, will not be possible if cases are delayed and callus forms around fracture surfaces. Indirect reductions are impossible under these circumstances. It would be an advantage to have new gadgets eg, talking drills that tell you the length of the screw, self-tapping biodegradable implants, precontoured plates, fracture glue, and some form of bone restorer.

We need to link up with our hip revision surgical colleagues to deal with this influx of osteoporotic acetabular trauma. In the acute phase, reconstruction is sometimes impossible or fruitless. It is now recognized that techniques, other than reconstruction, are available and are indicated when fractures are very comminuted or bone quality is poor. Within our unit at St George’s, there is close liaison between the fracture group and the hip reconstruction revision group.

In the more distant future, robotic surgery may become a possibility. On the biological front, there is encouraging work on cartilage replacement and nerve regeneration. We are still confronted on a regular basis with young patients with large areas of primary articular cartilage damage occurring at the time of an acetabular injury. Primary articular cartilage loss is irreversible and until we have a system of replacing it, we will not achieve good long term outcomes following a reconstruction of such injuries. One of the more devastating complications following a pelvic fracture is lumbo-sacral nerve injury. Young men are rendered impotent and women suffer neurological pelvic floor symptoms. In the future we may be able to replace areas of injured nerve thus reversing neurological damage, impotence, and pelvic floor weakness.

In the more distant future spare part surgery may become an option. New acetabular sockets may be available and perhaps whole sacral units with nerves attached may be pulled “off the shelf”.

If one looks at a UK £2 coin you will see written around the edge the saying “standing on the shoulders of giants”. Our understanding and advancement of pelvic and acetabular surgery relies on the work of our forefathers. I am privileged to have stood on the shoulders of Marvin Tile and will always be grateful for the teaching and advice he has given me.

**Bibliography**