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# Fractures of the Acetabulum

Second Edition  
Entirely Revised and Enlarged

With 458 Figures in 1754 Separate Illustrations,  
Some in Color

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## Dedication

It is a great pleasure for me to honour the members of the "Acetabular Fracture Club". The promotion of acetabular fracture surgery has now been passed on to them. They already know this speciality as well as me and practice it with very similar enthusiasm. All the members came to Choisy many times, either to improve their knowledge in this field or to discuss with me the most difficult problems these fractures may present. These pupils and friends are, in the order of their first stay at Choisy:

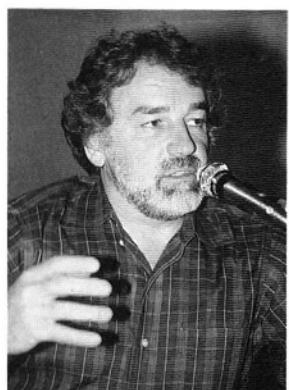
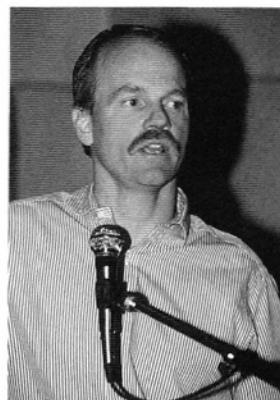
- Claude Martimbeau, MD, from Fort Smith, Arkansas, USA
- Joël Matta, MD, from Los Angeles, California, USA

- Jeffrey Mast, MD, from Detroit, Michigan, USA
- Keith Mayo, MD, from Seattle, Washington, USA
- Eric D. Johnson, MD, from Los Angeles, California, USA

With all of them, over the last 12 years we have organised hands-on courses in France or in the USA to teach younger surgeons, without forgetting to take the opportunity at these meetings to compare our results and techniques, always with one goal in mind: the improvement of acetabular fracture surgery. And out of our mutual interest in the acetabulum we have become close friends.

*Top right:* Claude Martimbeau.

*Bottom, from left to right:* Joël Matta, Jeffrey Mast, Keith Mayo, Eric D. Johnson.



## Preface to the Second Edition

At the request of our publishers, I accepted the task of preparing this second edition. I felt this was necessary for several reasons: new imaging technologies such as CT scanning and 3-D reconstructions are now used routinely, the indications for employing improved approaches are clearer, and reconstructions are facilitated by new internal fixation devices. Above all, I thought it was time to report the long-term results of the 940 acetabular fractures, 90% of which were treated surgically – a unique series.

In spite of the experience acquired from the three previous reviews of cases (1966, 1971, and 1978), I failed to foresee the amount of time this revision would need. In fact, it took more than 3 years to follow up the larger number of cases, and 159 patients (out of 800, i.e. 22.7%) were not included as they had moved since their last review and simply could not be located. At a time when it is in fashion to evaluate the cost of health care, it is strange to see how public administrators, so keen on evaluating the immediate cost of our operations, do not care about the quality of their long-term results, which appears to us, however, to be the best basis for the choice of the initial treatment.

Of 849 patients operated upon, 28 had less than 1 year follow-up, 74 had died, and 49 did not undergo true reconstructive surgery, so 698 patients were theoretically available for evaluation. We were able to examine personally 539 of them, that is 77.2%. Patients who died of a cause other than one having to do with acetabular fracture surgery (61 patients) and patients who were impossible to evaluate for this review but who had been followed up for more than 1 year (105 patients) are included in our statistics. So, on the whole, 705 patients, i.e. 88.12% of the series, are considered as having been evaluated.

On a much larger scale than for the previous reviews, patient data were computerised. We took particular care in attempting to evaluate the durability of the results, and in Chap. 26 we analyse the evolution of the results of patients who were evaluated in our successive reviews.

As far as the results are concerned, operated patients were divided into three groups according to the time of operation with respect to the time of injury. The largest group comprises patients operated on within 3 weeks from injury, when surgery is not always easy but the original fracture lines can be found. Patients operated on between 3 weeks and 4 months from injury form the second group. This group is characterised by the fact that during the healing process, which sometimes occurs rapidly, callus has formed, which must be totally removed, and the fracture lines have been remodelled, both factors increasing the difficulties of surgery. The third group comprises patients operated on more than 4 months after the injury, i.e. beyond the average healing time, and we have to deal with non-unions, mal-unions, or non-unions/mal-unions; then attempts at surgical reconstruction are attempts to salvage these hips from an early total hip replacement.

We continue to believe that total hip replacement is not a treatment for an acetabular fracture. Patients so treated because the condition of the femoral head precluded any attempt at reconstruction are not regularly included in our statistics.

The classification we established between 1961 and 1965 has stood the test of time and is widely used. Even if some other classifications are suggested, we regularly find our groups, but in a different order. The regular use of 3-D reconstruction confirms the description of the ten categories we proposed, with all the possible transitional forms. The new radiological technologies improve regularly, but are not yet reliable enough to be able to dispense with the systematic analysis of the three plain views we have promoted. That is why the teaching of these three standard views has been pursued and even increased.

We have done our best to analyse the results as precisely as possible – most importantly, the quality of the immediate reconstruction which was evaluated on the three views. The increasingly frequent use of the CT scan post-operatively demonstrated that what appears perfect on the three views may show some imperfections on CT sections, such as remaining step-offs of 1–2 mm. These hidden imperfections may explain the slightly increasing rate of osteoarthritis over the years, following cases we initially considered as perfectly reduced. Osteoarthritis developing 20–30 years after surgery is also attributed to the acetabular fractures, and this, of course, is very questionable.

What remains difficult is the evaluation of an imperfect reconstruction. Faults in reduction imply an intra-articular incongruence, which is most probably the dominating factor for long-term prognosis. The precise measurement of post-surgical and post-traumatic incongruence is still impossible today, which is why it is not possible to accurately establish the relationship between these incongruences and their long-term results either. However, it would be extremely helpful to know how much of the incongruence is compatible with a very good long-term result in determining indications for surgical treatment. We still feel the need for a precise method of evaluation of these imperfections and for some intra-operative means of control of the quality of the reduction before the time of wound closure.

Over the years we have been pleased to note that in many countries surgeons are showing an increasing interest in the field of acetabular fracture surgery.

Our frequent participation in symposia or lectures, in hands-on courses with practical exercises on pre-fractured plastic bones, and in X-ray lecture teaching in small groups demonstrates the regular improvement in the quality of the surgery achieved and in the knowledge of the surgeons who make special effort to learn about this difficult surgery.

Because of the difficulties involved in the surgery of acetabular fractures, an intensive period of learning is required, which, of course, will benefit both patients and surgeons.

We do hope that this second English edition will help to spread interest in acetabular fracture surgery and help in choosing the best type of treatment for each patient.

EMILE LETOURNEL  
December 1992

## Acknowledgements

However much he has done himself, an author does not forget that his book could not have come about without the contributions and encouragement of many others; when the time comes to express his gratitude, however, he is anxious not to forget any one. When speaking and reporting on a surgical activity of over 30 years, one cannot forget that the surgical work, which forms the basis of this book, cannot be accomplished without the assistance of the nurses in the operating theatre, on the ward and in the out-patient clinic, the orthopaedic staff residents, assistants, medical doctors, and other colleagues of the clinic who gave their assistance at various times. Also not to be forgotten are those doctors and surgeons from all over France and many other countries, too, who referred the patients who were treated.

The Administrative Council of the *Fondation de l'Avenir* and its president, Jean Pierre Davant, and the scientific council have intensively supported the review of the patients by providing us with all the computer means that such a study needed.

The Choisy Medical Surgical Centre and its director, Jean Jacques Monteil, have greatly contributed to this work. Most of the patients were operated on there, and all the patients were reviewed there, benefitting from all the financial and human facilities that such a centre has to offer – in the orthopaedic department as well as in the radiology department and the out-patient clinic.

Robert Palau, head of the radiology department at “Choisy”, not only helped out in the radiological evaluation of the patients, but, with his extensive knowledge in the communication field, has developed the software which allowed us to computerise our data.

Jean Pierre Moulinie, the internist and anaesthesiologist in the orthopaedic department of Choisy, handled all the patients pre- and post-operatively. He also wrote the chapter on the prevention of D. V. T. and infections.

My secretaries, and particularly Michèle Rosec, did a great job in using all resources available to try and get in touch with the patients and in trying to convince them of the usefulness of the follow-up study.

John Lyttle, from Little Rock, Arkansas, USA, spent 1 year of residency with me and contributed widely to the evaluation of the clinical and radiological results. Bruce Buhr, from Kansas City, Missouri, USA, began his residency at Choisy when I had just started to correct the proofs of this book. He helped me in pursuing the typing errors, in checking the tables, and in correcting my English. Remy Serr has been responsible for the preparation of most of the X-ray illustrations and intra-operative pictures. He is also the man who manipulates the Judet table so wonderfully and positions the patients so well.

The Osteo Company, Switzerland, and its President, Mr. Beat Leu, trusted me enough, more than 10 years ago, to consider manufacturing the first complete armamentarium for acetabular fracture surgery.

Our publisher, Springer-Verlag, deserves all our grateful thanks. They accepted all the changes we felt necessary to make to the first edition. The incredible improvement in their editing techniques over the last 10 years made our work and communication with them very easy. They paid regular and very close attention to the quality of the illustrations and did their best to have this book published as quickly as possible. I want to thank personally Ms. M. Aryan, Mr. A. Gösling, the production editor and Ms. K. Wagstaff, the copy editor who had the task of correcting my English.

Finally, this book owes a lot to Francine. She was responsible for inputting all the information into the computer, and for the computerised analysis of the cases. She also typed all the changes and additions we decided to make in revising the first edition. Nobody knows, except for me, the number of hours, evenings and week-ends she has spent to give birth to this second edition. She deserves my very special and "affectionate" thanks.

## Preface to the First Edition

It has been a pleasure to comply with requests to publish this book in English. During the intervening years, there has been little to add to our views as to the best management of acetabular fractures, but an additional chapter has been incorporated comprising recent findings in our patients and slight changes in emphasis on the indications for operations.

Additionally, having recognised that one of the greatest difficulties in this method of treatment lies in the pre-operative assessment of the standard radiographs, we have prepared a short series of radiographs which the reader may find advantageous for study.

We are grateful to Mr. REGINALD ELSON who has translated and revised the French edition. Considerable alteration of the text and the general presentation was necessary in order to make the material palatable in English.

Our thanks are due to our new publishers, Springer-Verlag, for their keen interest and skill.

E. LETOURNEL  
R. JUDET

## Editor's Preface to the First English Edition

It is a privilege to have been entrusted with the preparations of the English edition of this book. I have been aware of the authors' work for some years and personal observation has inspired enormous respect for their experience and expertise in this field. Undoubtedly, the information they present forms a unique collection.

As a practising orthopaedic surgeon, I feel bound to warn colleagues not to approach the subject lightly. Even now, having translated every sentence, I find aspects here and there difficult to comprehend. The authors have lived with the work for years and this shows abundantly in their ability to interpret radiographs and to operate. It is necessary to learn some new terminology, not difficult in itself but requiring effort nevertheless; thereafter, having grasped the classification and basis underlying the spectrum of fractures, their interpretation from radiographs is more straightforward. Even here, the average orthopaedic surgeon will be surprised how much effort is necessary to appreciate the fractures in three dimensions. The operations are logical but always of considerable magnitude. Undoubtedly, the anterior approaches should be practised on a cadaver. The number of fractured acetabula likely to be encountered by one surgeon is going to be small and practical experience hard to acquire. If open operation is to be encouraged, it is yet another procedure which should be centralised; after resuscitation and treatment of other injuries, operation on the acetabulum is not urgent (apart from reduction of a posterior dislocation); after a week, the majority of patients can be transported. The authors themselves warn against operating unless the necessary background study has been performed. Chapter 2 may be read to advantage *after* study of radiology and the classification in Chapter 3.

A superficial appraisal of post-operative radiographs gives the impression that the surgeon has scattered metal irresponsibly. In fact, when exposed at operation, the application of the plates and screws is so obviously correct; one of the most remarkable features is the immediate solidity obtained when all goes to plan, even in the most complex fractures.

In the translation, I have tried to render the French presentation into a style acceptable to English readers and yet preserve some of the original flavour. Much of the French text is in the first person and sounds foreign to us; nevertheless, while putting into the third person passive the authors' recommended instructions and teaching, I have left in the first person their discussion when this related to what *they* did in treating their patients or when they debate on opinion.

It is remarkable how many terms cannot be translated directly. For example, the French call the root of the superior pubic ramus, *le corps* (body) *du pubis*, while *our* body of the pubis becomes *la lame quadrilatère* (the quadrilateral plate) *du pubis*.

I wish to thank VALERIE BARCLAY and ANN JOHN who typed the manuscript.

Finally, there are a number of features on the innominate bone of which nomenclature may cause problems. A glossary of these is appended in the hope that the defined meaning will aid the reader who decides to pursue a study of the subject.

REGINALD A. ELSON

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# Glossary

Acetabular notches	both anterior and posterior lips of acetabular margin present with well defined indentations in their mid-parts
Acetabulo-obturator line	radiological landmark described in Sect. 3.2.1
Anterior pillar	thickened area of iliac wing which supports gluteus medius tubercle
Anterior tubercle of obturator foramen	tubercle located on margin of obturator foramen at junction of inferior pubic ramus and ischial ramus
Gluteal surface	external iliac fossa
Gluteus medius tubercle	tubercle of iliac crest
Innominate bone	used throughout text for os innominatum or pelvic bone
Interspinous notch	area of anterior border of innominate bone between anterior superior and anterior inferior iliac spines
Ischio-pubic notch	recess at junction of body of ischium with root of superior pubic ramus
Marginal impaction	(French: fracture mixte) – the impaction and incarceration into the underlying cancellous bone of small osteochondral fragments from the shattered margin of the acetabulum (further explanation on page 35)
Obturator ring	convenient description of the whole bone structure enclosing the obturator foramen
Osteosynthesis	widely used and convenient term which embodies reduction <i>and</i> fixation of fractures
Pelvic brim	refers to brim of true pelvis: an anatomically complex formation which could be variously called ilio-pectineal, innominate or (posteriorly) arcuate lines
Posterior tubercle of obturator foramen	tubercle located on margin of obturator foramen at junction of body of ischium and pubic ramus
Psoas gutter	ilio-pectineal surface of innominate bone in which the psoas lies at its departure from the pelvis
Root of superior pubic ramus	that part of the superior pubic ramus which contributes to the acetabulum (in French: body of the pubis)
Sciatic buttress	condensation of trabecular bone which related to the angle of the greater sciatic foramen and formed by system described in Sect. 1.4
Sciatic nerve	its two large branches are named in this book: lateral popliteal (= Common peroneal nerve) and Medial popliteal (Tibial nerve)
Sub-cotyloid groove	groove under overhanging lip of postero-inferior aspect of inferior horn of articular surface
Teardrop	commonly used radiological feature which the French call (more accurately) a “U”