the shoulder in sport

management, rehabilitation and prevention

CHURCHILL LIVINGSTONE
ELSEVIER

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Translated by Helen Wormald

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He practises independently as a physiotherapist in Genoa, treating athletes, and movement professionals and artists. He is a consultant to many sport and artistic institutions, including the Italian Sailing Federation (FIV), the Associazione Valdostana Maestri di Sci (AVMS) and the Carlo Felice Theatre in Genoa. His experience as a volleyball and beach volleyball player, an accomplished practitioner of winter sports, a physiotherapist and trainer in water polo and sailing, as well as a practitioner of kinomichi and aikido, have helped in his quest for quality in movement as a fusion of efficiency, health and harmony.

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He has published several papers in national and international scientific journals and, in addition to his role as rapporteur at national and international scientific conventions, currently has an independent physiotherapy practice in Pesaro (PU).

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Abbreviations

ABD abduction
ABER abduction and external rotation position
AC joint acromioclavicular joint
ADD adduction
AIOS acquired instability by overuse syndrome
ALPSA anterior labral periosteal sleeve avulsion
AMBRII atraumatic multidirectional bilateral rehabilitation inferior capsular shift
ANAN National association of swimming and water polo trainers
AP anteroposterior
ARV average rectified value
BFE basic functional examination
BLB bone-ligament-bone
CC correlation coefficient
CC load capacity threshold
CKC closed kinetic chain
CONI Italian national olympic committee
CRaC contract-relax-antagonist-contract
CT Computed tomography
CTF doctor of chemistry and pharmaceutical technology
CV conduction velocity
DOMS delayed onset muscular soreness
EBM evidence based medicine
EMG electromyography
ER external rotation
ERLS external rotation lag sign
ERs external rotators
EXT extension
FE functional evaluation
FI fatigue index
FRA Fédération française d'athlétisme
FTPI functional throwing performance index
GARD glenoid articular rim disruption
GAS general adaptation syndrome
GHL glenohumeral ligament
GIMBE Italian evidence-based medicine group
GLAD glenolabral articular disruption
HAGL humeral avulsion of the glenohumeral ligament
HAMD Hamilton depression rating scale
HR heart rate
IASP International association for the study of pain
ICD International classification of diseases
ICF International classification of functioning
ICFDH International classification of functioning, disability and health
ICIDH-2 International classification of impairments, disabilities and handicaps
ICR instantaneous centre of rotation
IEFCoSTRe European institute of training, systemic consultancy and relational therapy
IGHL inferior glenohumeral ligament
IGHLC inferior glenohumeral ligament complex
IPQ Italian pain questionnaire
IR internal rotation
IRLS internal rotation lag sign
IRRST internal rotation resistance strength test
IRs internal rotators
IZ innervation zone
KEMG kinesiological electromyography
LHB long head of the biceps
LHBB long head of the biceps brachii
LHHB long head of the humeral biceps
MDF median frequency
MDI multidirectional instability
MIP minimal invasive portals
MLCM multidimensional load/carriability model
MMT manual muscle test
MNF mean frequency

Abbreviations

MPQ McGill pain questionnaire
MR magnetic resonance
MRC medical research council
MRI magnetic resonance imaging
MSR muscle strength ratio
MU motor unit
MUAP motor unit action potential
NPV negative predictive value
NWC number of words chosen
OKC open kinetic chain
OT overtraining
OTS overtraining syndrome
PAE passive anterior elevation
PD proton density
PHP prognostic health profile
PL posterolateral portal
PNF proprioceptive neuromuscular facilitation
PPI present pain intensity
PPT pain provocation test
PPV positive predictive value
PRIr pain rating index rank
PRIrc pain rating index rank coefficient
PROM passive range of motion
RC rotator cuff
RHAGL reverse humeral avulsion of the gleno-humeral ligament
RMS root mean square value
ROM range of movement
Rx radiology
SASES Society of American Shoulder and Elbow Surgeons
SC sternoclavicular joint
SDA sedentary daily activities
SENIAM surface electromyography for non-invasive assessment of muscles
SIP sickness impact profile
SLAC superior labrum, anterior cuff lesion
SLAP superior labrum from anterior to posterior
SP scapular plane
SPADI shoulder pain and disability index
SSC stretch-shortening contraction
SSI shoulder severity index
SSP shoulder surgery perception
SSRS subjective shoulder rating scale
SST simple shoulder test
TOS thoracic outlet syndrome
TUBS traumatic unidirectional Bankart-lesion surgery
ULTT upper limb tension test
US ultrasound
VA verbal analogue
VAS visual analogue scale
VUB Vrije Universiteit Brussel
WHO World Health Organization
2D two-dimensional
3D three-dimensional

Preface

Shoulder disorders generally affect athletes involved in certain sports, and their incidence has increased dramatically in recent years owing to the ever-growing demand for extremely high levels of performance throughout long, competitive seasons and with ever-shorter intervals between competitive events.

The growth in the numbers of Italians taking part in sports (12–14 million) has meant that many amateur sportsmen and women are now interested in these problems.

There is additionally a tendency to start youngsters competing early, exposing structures that have not yet matured to acute, repetitive stresses, thus increasing the risk of developing dysfunctional conditions, a prerequisite for subsequent disorders.

The world of sport, therefore, clearly has significant expectations, and eagerly awaits progress in the diagnostics, rehabilitation and surgery of the shoulder.

Owing to recent progress in these fields and to a considerable increase in the scientific literature produced in recent years, it has been possible to abandon terms such as 'scapulohumeral periarthritis' in favour of a more accurate interpretation of shoulder disorders. Such an interpretation is supported by a solid biomechanical and functionalist view of disorders which are primarily multifactorial in origin.

The various causal or risk factors can be correctly identified and excluded only by means of an interdisciplinary approach involving the various professions in an effort to overcome the obstacles to a common, synergic vision.

This book presents the most important advances in the disciplines involved in the prevention and cure of sport injuries with the aim of stimulating a productive interdisciplinary collaboration between physiotherapists, doctors and specialists in motor sciences, while respecting the individual disciplines.

Functional anatomy, surgery, manual therapy, motor rehabilitation, athletic training and technique are dealt with in separate chapters, investigating specific fields such as arthrokinematics, diagnostic imaging, surgical endoscopy, surface electromyography and musculoskeletal therapy.

Acute disorders of the shoulder have been approached from epidemiological, clinical and surgical points of view, while subacute and chronic disorders, which are more widespread and problematic, have been addressed from the point of view of rehabilitation and prevention.

Rehabilitation, with its close links to athletic training, has been examined in particular, along with the prevention of sport injuries, particularly since the latter is sometimes neglected in training programmes. The structure of the book in sections by discipline, supported by an extensive bibliography and some 'unresolved problems', reflects the state of the art thanks to contributions from leading experts in the various fields.

The editors, who are physiotherapists and lecture on the Master's course in the 'Rehabilitation of Musculoskeletal Disorders' at Università degli Studi di Genova, hope that this work will meet the needs not only of health workers and technicians working in the field of sports, but also of lecturers in Physiotherapy and Motor Sciences and students at Specialist Medical Schools who are involved in various roles in the evaluation, treatment and rehabilitation of athletes.

Finally, it is hoped that the work that has been done will help to achieve an interdisciplinary culture with the aim of safeguarding the health of athletes, the fundamental human resource and 'primum movens' of all sport.

A. Fusco, A. Foglia, F. Musarra and M. Testa

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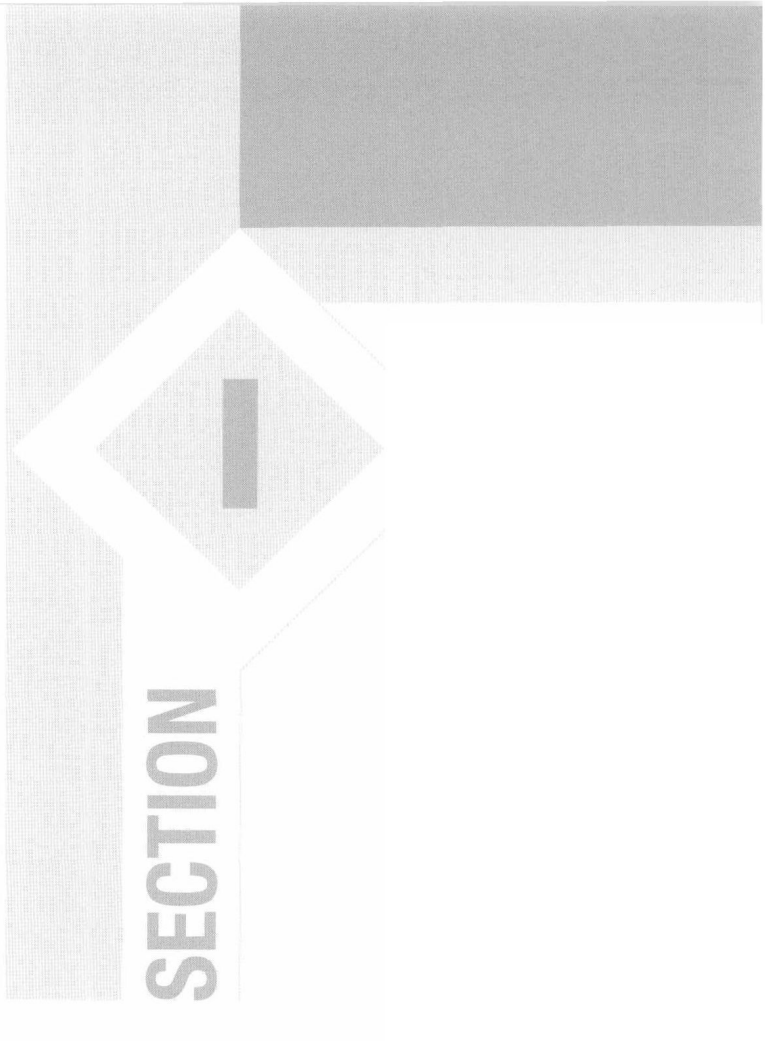

FUNCTIONAL ANATOMY AND RECENT BIOMECHANICAL DISCOVERIES

CHAPTER 1

ANATOMICAL VARIANTS OF THE SHOULDER

P. Van Roy
E. Barbaix
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M. De Maeseneer
J.P. Clarijs

Congenital anomalies, like pathological anomalies, of the glenohumeral joint, the acromioclavicular joint (AC joint) and the ligaments surrounding the shoulder may predispose to, or aggravate, impingement of the supraspinatus outlet, for example, an acromial bone, osteophytosis of the inferior surface of the acromioclavicular joint, or calcification and ossification of the coracoclavicular, coracoacromial and glenohumeral ligaments, bursae and tendons.

As well as giving an overview of the bone variants of the glenohumeral joint, the coracoacromial arch, and the acromioclavicular and sternoclavicular joints, this chapter will present a series of clinically significant soft tissue variants. Many anatomical variants can be found concerning the glenoid labrum, the glenohumeral capsule, the glenohumeral ligaments, and the corresponding bursae, as well as the muscles surrounding these structures, and their vascularization and innervation. The possibility of clearly visualizing the soft tissues in magnetic resonance has prompted renewed interest in the various aspects of anatomical variants, owing to their clinical consequences and the need to avoid errors in interpretation.

Glenohumeral joint

Bone structures of the glenohumeral joint

The anatomical variations of the glenoid fossa affect its shape, curvature, orientation and dimensions. Although some glenoid fossae are oval or ovoid, the majority of scapulas have an articular surface that is pear- or comma-shaped at the humeral head (Fig. 1.1). The pear-shape may be the result of the presence, in the upper part of the glenoid cavity, of a smaller anteroposterior diameter, which may be accentuated by the presence of an acetabular notch in the anterior margin. Prescher (1997) reports the presence of a glenoid notch in approximately 55% of cases. This notch causes asymmetry between the anterior and inferior halves of the glenoid cavity (Huber, 1991). As a result of this indentation, a small area of the anterior glenoid labrum does not insert in the rim of the glenoid cavity. A small anterior sublabral hole can be found there (Prescher, 1997). The articulation between the relatively small glenoid cavity and the far larger humeral head predisposes the joint to instability and consequently makes it subject to various types of dislocation. Saha (1971, 1973) points out that to ensure a stable joint configuration, the maximum and minimum diameter of the glenoid cavity should be approximately 75% and 57%, respectively, of the diameter of the humeral head.

A further aspect influences the degree of congruence between the humeral head and the glenoid cavity. Some glenoid cavities are shallow, while others are more sharply concave.

A classification has been devised, based on the size of the radius of curvature of the glenoid fossa in relation to the diameter of the humeral head (greater, equal or smaller), which distinguishes three types of glenoid fossa (A, B and C) (Saha, 1971; Soslowski, 1992; Van der Helm, 1994). In these typologies, the relation between the curvature of the joint surfaces is generally observed in the transverse plane. Iannotti (1992) notes that the humeral head is spherical if