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FROM THE ARCHIVES

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Internal architecture of the proximal femur – Adam's or Adams' arch? Historical mystery

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Abstract The designation 'Adam Bogen' describing the thick medial cortex of the femoral neck is an incorrect term. This arch was described by Robert Adams (1795–1871), an outstanding Irish anatomist and surgeon. He was famous mainly for his book on gout and the description of disorders of cardiac rhythm, the so-called Adams-Stokes syndrome. He published his original description in the today unfortunately almost forgotten *Cyclopaedia of Anatomy and Physiology*, Vol. II (London, Longman, 1836–1839). The main editor of this monumental six-volume work was the famous anatomist and surgeon R.B.Todd. This book represents a significant source of information on diseases and injuries of the great joints (shoulder, elbow, wrist, knee, ankle).

Keywords Architecture of proximal femur · Adams' arch · History of orthopaedics

A thick medial cortex of the femoral neck (incorrectly called calcar femorale in the English literature [6]) is called *Adambogen* or *Adamscher Bogen* (Adam's arch) in the German orthopaedic and traumatological literature of second half of the 20th century. This term was most probably used for the first time by M.E. Müller in 1957 [15], and then by Pauwels [16], but in particular it occurs in the literature dealing with trochanteric fractures [3, 4, 7]. All of the aforementioned authors explicitly use the term *ADAMscher Bogen* or *Adambogen* (Adam's arch). However, none of them present any literary source which would explain the origin of this eponym. In addition, in Handlexikon der Medizin [23], the description of the arch (Adamsbogen) is related to William Adams (1820–1900), an outstanding English surgeon of 19th century, although his biography does not indicate that he ever dealt with the proximal femur [8].

The English anatomical literature does not know the term Adams' or Adam's arch. In the German anatomical literature, this term is not known either. None of the famous anatomists of 19th century who dealt with the architecture of the proximal femur such as H. Meyer [14], F. Merkel [13], or J. Wolff [25] used the term Adams' or Adam's arch or mentioned any author of such name. The only exception is the monograph by Lanz and Wachsmuth from 1938 [10]. On page 424 it is stated that the powerful medial cortex of the femoral neck is usually described as *'ADAMschen Bogen*', unfortunately without any reference to the literature. There are several questions arising from the above-mentioned facts. Was the actual original author Adam or Adams, and who was he? Who used this eponym for the first time, and how did it come to appear in the German literature?

After more than 15 years of investigation, I have incidentally succeeded in finding the original source, namely *The Cyclopaedia of Anatomy and Physiology*, Vol. II (London, Longman, 1836–1839) [1]. The main editor of the monumental six-volume work is the famous English anatomist and surgeon R.B. Todd. It is a very detailed encyclopaedia (lexicon) which also touches on clinical medicine. The heading or rather an extensive chapter on 'Hip-Joint, Abnormal Conditions' was worked out by Robert Adams, an outstanding Irish anatomist and physician. He lived in the years 1791–1875 and became famous for a book on gout and mainly for the description of the disorders of cardiac rhythm today known as the Adams-Stokes syndrome. The chapter 'Hip-Joint, Abnormal Conditions' is rather extensive and deals with many clinical conditions such as congenital luxation, arthritis, osteoarthritis, traumatic dislocation and fractures. The issue of proximal femur fractures is worked out in great detail, including figures, and refers to a number of English and French authorities from the beginning of the 19th century. Robert Adams inter alia argues here with Sir Astley Cooper concerning the healing of intracapsular fractures of the femoral neck. In the description of extracapsular fracture

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of the femoral neck (the drawing clearly shows that it was a case of peritrochanteric fracture), he points out the significance of the powerful cortical arch ... 'the principal strength of the neck resides in an arch of compact tissue, which begins small where the globular head joins the under part of neck, but which gradually enlarges downwards towards the lesser trochanter'... for the stability of the proximal femur. He also shows the arch on the section through the normal (unaffected) end of the femoral bone. In this, he refers to his preceding description in '*Dublin Journal,* vol.vi, p.222' (i.e. the *Dublin Journal of Medical and Chemical Science*). Here another famous Irish surgeon, Robert William Smith (1807–1873), published his lecture on the diagnostics of fractures of the femoral neck in which he cites a long passage that he borrowed from Adams mentioning there the significance of the thick medial cortex of the femoral neck and supplementing the respective drawings [21]. In addition, R.W. Smith was the first to use the term Colles fracture [17]. In 1850 he published a significant work on fractures containing an extensive chapter on fractures of the femoral neck [22].

Thus, the mystery of the authorship has been clarified, and the only question remaining is who used the term Adams' arch for the first time. R.B. Todd and W. Bowman [24] describe and show the thick cortical arch in their textbook, but without mentioning Adams. The same applies to other German and English anatomists of the 19th and the beginning of the 20th century. In their work they mainly deal with the architecture of the cancellous bone; the thick arch of the medial cortex of the femoral neck is mentioned only briefly, but its drawing is presented.

In the English surgical literature, the description of the arch is mentioned in Smith's monograph [22] where he again cites literally the description by R. Adams from Todd's cyclopaedia, to which he refers.

The first description of the arch associated with the name of Adams was found in the works of an outstanding American surgeon N. Senn [18, 19, 20]. In the first of them published in 1883, he uses the term *Adams's arch* [18]. In another work of the same year and published in the same journal, however, we may already read: '..A portion of Adam's arch, which had been implanted into lower fragment, could be distinctly seen in the spongiosa, on making a vertical section' [19]. Senn also used the same term, i.e. Adam's arch, in another publication [20]. It may be assumed that his information source was probably Smith's monograph [22] and possibly also Todd's '*Cyclopaedia*' [1]. Although he does not cite either of these sources, due to the fact that he owned a library of more than 6000 volumes and had been intensively dealing with the issues of the fractures of femoral neck, we may assume that these books were part of his library. Thus, it seems that it was Senn who introduced the term Adams's arch and subsequently distorted it to the form of Adam's arch.

Another mention can be found only 41 years later in Faltin [5]. In his historical outline of the treatment of the fractures of the femoral neck, he describes '..a powerful cortical layer, called Adam's arch'. Along with a number of significant authors, he mentions Senn in the text, but neither Adams nor Smith. It is possible that he took over the term Adam's arch from Senn. Unfortunately, he presents no other literary citations than names.

Only 100 years after the primary description does the term Adams' arch appear in a distorted form in the German anatomical literature in Lanz and Wachsmuth [10]. Nevertheless, the term Adams' (Adam's) arch is not known to other German authors of significant works dealing with the clinical anatomy of the hip joint [9, 11]. The term Adam Bogen entered the German literature [3, 4, 7, 15, 16] most probably from Faltin's work. No other source has been found so far.

The history of Adams' arch poses certain questions which still await solution. However, there are three issues which are of the greatest interest in this history.

The first one is the personality of Robert Adams. He is still known mainly thanks to the Adams-Stokes syndrome, and his major work is considered the book on gout and rheumatoid osteoarthritis. Nobody mentions in his biography his contribution to the treatment of proximal femur fractures. Another one is the reappearance of Todd's cyclopaedia. This book is practically unknown to current authors, even to Peltier [17]. The only exception is Lauge [12], who mentions the chapter on the ankle which was also written by Robert Adams. It was this citation which brought me to the actual author. At the same time, R. Adams again describes in the cyclopaedia the diseases and injuries of other great joints (shoulder, elbow, wrist, knee, ankle) similar to the hip. This significant source of information should not pass unnoticed.

The third issue which is not properly appreciated is the contribution of the 'Dublin surgical school'. The main authority at the beginning of 19th century from the viewpoint of fractures of the femoral neck is considered to be Sir Astley Cooper. From the Dublin school only Colles' work of 1818 [2] is known and only to a narrow circle of authors. R. Adams remained practically unknown, and the same applies to the work by R.W. Smith [21]. In current historical overviews, only Peltier [17] mentions his monograph of 1850. At the same time, the descriptions of their cases are very extensive and detailed and provide much more information than Cooper's description. In addition, 'the Dublin School' cite a number of authors of that period and in many points argue with Cooper's ideas. Thus, with a certain overstatement we may ask: What in fact has started with Adam, or rather Adams?

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Appendix

After sending the article for publication, another two very important sources were found. In the Kocher's monograph dealing with proximal femur fractures [26], the author mentions *Adam'schen Bogen* in the description of the femoral neck. Several pages earlier, he cites Senn's work of 1883, which was most probably his information source.

In *Encyklopädie der gesamten Chirurgie* of 1901 of which Kocher was co-editor, Lossen from Heidelberg presents the term *Adams'schen Bogen* under the heading *Femurfracturen* [27]. At the same time in the literature relating to this heading, he cites Kocher's book! It is interesting what may be caused by a mere shift of the apostrophe. As a result, the term *Adam's arch (Adam Bogen)* has most probably come to the German anatomic and surgical literature either directly from Kocher or later from Faltin.

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