Anterior cervical discectomy with fusion (ACDF) is a very well-known and often-performed procedure in the practice of spine surgeons. The earliest descriptions of the technique have always been attributed to Cloward, Smith, and Robinson. However, in the French literature, this procedure was also described by others during the exact same time period (in the 1950s).

At a meeting in Paris in 1955, Belgians Albert Dereymaeker and Joseph Cyriel Mulier, a neurosurgeon and an orthopedic surgeon, respectively, described the technique that involved an anterior cervical discectomy and the placement of an iliac crest graft in the intervertebral disc space. In 1956, a summary of their oral presentation was published, and a subsequent paper—an illustrated description of the technique and the details of a larger case series with a 3.5-year follow-up period—followed in 1958.

The list of authors who first described ACDF should be completed by adding Dereymaeker’s and Mulier’s names. They made an important contribution to the practice of spinal surgery that was not generally known because they published in French.

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In their introduction, Dereymaeker and Mulier mentioned that 2 procedures were known for treating cervical discopathy: laminectomy and immobilization by posterior arthrodesis. They stated that the results of these procedures were not satisfying because of the potential extensive trauma to the spinal cord and spinal nerve roots. It was for this reason that they developed an alternative approach. In 3 lines, they explained their method: total removal of the disc via an anterior approach (similar to what is done nowadays) and fusion of both adjacent vertebral bodies, achieved by placing a coin-shaped piece of bone within the intervertebral space. Control radiographs showed a good result.

Dereymaeker and Mulier continued by stating that the procedure was effective in eliminating the cause of the disease and in achieving a good-quality immobilization. The procedure was restricted to the affected segment, and the spinal cord and nerve roots were not placed at risk. They concluded by reporting that ACDF had been performed in 5 patients and that the results had been satisfying.

A discussion paper by A. Ricard followed. He appreciated the presentation but had 2 concerns. First, he wondered...
whether all cervical discopathies should be approached anteriorly. In cases of spinal cord symptoms, he could imagine approaching from the front. However, if the patient suffered from only radicular symptoms, a posterior approach (as described by Frykholm) should, in his opinion, be used. The disc was not responsible for the symptoms in that case, and liberation of the nerve root would result in resolution of the inflammatory and vasomotor reaction, which in his opinion was the cause of the syndrome.

Second, Ricard was concerned about the intervertebral graft, which results in a completely stiff segment. Although he had defended the practice of lumbar spine fusion very often, Ricard considered that a solid fusion in the cervical spine would be difficult to accomplish because of the degree of mobility in this part of the spine. Moreover, because of the stiffness of the fused section, and liberation of the nerve root would result in resolution of the inflammatory and vasomotor reaction, which in his opinion was the cause of the syndrome.

Second Article

In 1958, Dereymaeker and Mulier described the procedure in detail (Fig. 2) after they had explained their assumptions about the approach, referring to the often-encountered complications related to manipulation of the spinal cord in cases involving a posterior approach. They cited several articles that concerned lumbar arthrodesis but also the report by Robinson and Smith that had been published since their initial description of ACDF.

Dereymaeker and Mulier discussed the advantages and pitfalls of the anterior approach before reporting the results obtained in a series of 30 patients. They cited the absence of mortality as one of the advantages. Furthermore, since the approach did not involve contact with neural structures, the risk of injuring the spinal cord or nerve roots was avoided. Additionally, when the graft had been applied correctly, the quality of the fusion was excellent. After several months, the adjacent vertebral bodies would form an osseous block through the intervertebral graft.

Drawbacks were also reported. As the authors stated, when the graft was not properly placed, it became dislodged ventrally, and fusion in such cases was not achieved. Incomplete cleaning of the endplates, in addition to incorrect placement of the graft, was mentioned as a cause of nonfusion. They had never seen any example of the arthritic changes suggested by Ricard.

Postoperatively, the patients were immobilized for 2 weeks and were then allowed to mobilize. The follow-up period was between 16 months and 3.5 years. Half of the patients suffered preoperatively from paraplegia in combination with brachial radicular symptoms. Patient characteristics were presented in a table, and 4 patients were discussed in more detail, including a discussion of pre- and postoperative radiographic features.

In the discussion, the safety of the procedure was emphasized. Dereymaeker and Mulier noted that the clinical result in each case was dependent on the clinical syndrome. A radicular syndrome was associated with a good outcome, whereas spinal cord compression was associated with a more diverse clinical outcome. Patients diagnosed with amyotrophic lateral sclerosis did not benefit from the surgery. The authors concluded that the indication for surgery in cases involving a radicular syndrome was rather straightforward.
Albert Guillaume Dereymaeker (Fig. 3) was born on June 15, 1916, in Anderlecht, Belgium. He started medical school at the Catholic University of Leuven, Belgium, in 1933. In 1940, he completed his medical education.

From 1936 to 1937, Dereymaeker carried out research at the Department of Anatomy and Embryology (under Prof. E. van Campenhout). His research concerned the development of the orthosympathetic system within the embryo of the chicken and the origin of the nervous system within the gastrointestinal tract.

During the early phase of the Second World War,
Dereymaeker became a neurological resident in the Department of Neurology of Hôpital Saint-Pierre in Leuven (under Prof. P. van Gehuchten). After only 6 months, in 1941, neurosurgery intrigued him more than other fields and he became a neurosurgical resident in the neurosurgery department (under Dr. C. Lenshoek) that was a part of the Department of Neurology (under Prof. B. Brouwer) at the University of Amsterdam. In the same year, he became an extraordinary aspirant member of the Belgian National Fund for Scientific Research (currently the Fund for Scientific Research).

On August 13, 1942, Dereymaeker married Isabelle Nathalie Louise Lams. They raised 2 daughters and 5 sons and he became a neurosurgical resident in the neurosurgery department (under Dr. C. Lenshoek) that was a part of the Department of Neurology (under Prof. B. Brouwer) at the University of Amsterdam. In the same year, he became an extraordinary aspirant member of the Belgian National Fund for Scientific Research (currently the Fund for Scientific Research).

On August 13, 1942, Dereymaeker married Isabelle Nathalie Louise Lams. They raised 2 daughters and 5 sons (http://gw.geneanet.org/jeanpaes?n=dereymaeker&oc=&page=albert+guillaume). In 1942, he was appointed as foreign resident at the neurosurgical department of Hôpital de Pitié in Paris (under Prof. Cl. Vincent). In 1943, he became an aspirant member of the National Fund for Scientific Research and started his scientific research at the neuropathological laboratories of the University of Leuven (under Prof. P. van Gehuchten) and of the Free University of Brussels (under Prof. A. Dustin). In the meantime, he was a resident at the Department of General Surgery, Free University of Brussels, under the supervision of A. Depage, MD, PhD. At the end of 1943, he became a neurosurgical resident at the Catholic University of Leuven.

In 1945 and 1947, his scientific ambitions were acknowledged when he was appointed researcher and “competent researcher,” respectively, of the Belgian National Fund for Scientific Research. In 1948, the Royal Academy of Medicine of Belgium gave Dereymaeker an award celebrating his scientific output. In 1949, he was appointed a senior lecturer at the Catholic University of Leuven after defending his thesis about icterus. In the same year, he was appointed chief of the neurosurgical department at the University of Leuven. This appointment came shortly after neurosurgery separated from general surgery. In 1948, the first neurosurgical department in Belgium was founded by Prof. Paul Martin at the Institut Héger-Bordet, the Free University of Brussels. In 1955, Dereymaeker became a professor. He remained clinically and scientifically active thereafter. His scientific contributions to literature concerned mainly neurosurgical issues of the brain. In 1966, he wrote an article about his experience with ACDF.

Prof. Dereymaeker was an inspiring man who understood the art of connecting people. According to Prof. R. van den Bergh, chair of the Department of Neurology and Neurosurgery at the University Hospital Gasthuisberg in Leuven, one of his major merits was his collaboration with Prof. P. van Gehugten in the construction of the Institute of Neurology in Leuven, which was officially inaugurated in 1952. Dereymaeker was one of the founders of the Belgian Society of Neurosurgery, which came about in 1961. He served as president of the Belgian Society for Neurology in 1962 and played a prominent role in many international and national societies and councils. He died on April 25, 1988, in Woluwe-Saint-Lambert, Belgium.

Joseph Cyriel Mulier

Joseph Cyriel Mulier (Fig. 4) was born on March 13, 1922, in Leuven, Belgium. He received his medical degree in 1947 from the Catholic University of Leuven. He married Wilhelmiene Lahaye, with whom he had 2 sons and 4 daughters.

In 1950, after the intervention of Dr. Verbrugen, a leading Belgian orthopedist, Mulier moved to the United States to enter orthopedic surgery residency at the University of Iowa. The Belgian-American Education Foundation, established by Herbert Hoover, supported Mulier’s residency in Iowa City. After completing his residency and receiving a master’s degree in orthopedics in 1953, Mulier returned to Belgium, where he became a lecturer and docent of orthopedics and traumatology. Shortly thereafter, he became the first professor of orthopedic surgery in Belgium and chair of the department of orthopedics. In 1964, he was one of the cofounders of the Vlaamse Vereniging van Orthopedie en Traumatologie (VVOT, or the Flemish Society for Orthopedics and Traumatology), of which he was the first president, in which capacity he served until 1980. Apart from the 2 articles that are the subjects of the present paper, he did not otherwise publish about specific spinal entities. He died on March 24, 2017, at the age of 95 years.
Discussion

The publication of the oral presentation by Dereymaeker and Mulier is one of the oldest publications about ACDF in a peer-reviewed journal. This contribution has been mentioned only briefly by Brunon et al. in a French journal. Because of the language of the original contribution and the latter ones, the ACDF publications remained unnoticed by the majority of English-speaking readers. The contribution by Dereymaeker and Mulier is very infrequently mentioned in English-language articles. Like the contributions of Cloward and Smith and Robinson, the manuscripts of Dereymaeker and Mulier are landmark papers considering the original description of ACDF. Dereymaeker and Mulier belong on the list of pioneers with Cloward, Smith, and Robinson when discussing the history of ACDF.

While investigating the contribution of Dereymaeker and Mulier, we found several aspects to be remarkable. First, a similar approach was developed on 2 different continents. It was very likely that the groups did not know of each other’s work, since communication possibilities were different than they are nowadays.

However, an anterior approach to the cervical vertebral bodies for mainly infectious etiologies had already been described in 1894. Antony Chipault described the pre-sternocleidomastoid muscle approach, originally described by Burckhardt, and the retro-sternocleidomastoid muscle approach. His motivation for these approaches was to assess pathology within the anterior part of the spine without entering the spinal canal.

The argument for approaching a compressive agent anteriorly is clear: one avoids manipulation of the spinal cord, which can cause severe neurological deficits. This awareness, in combination with the knowledge of the anteriorly located origin of radicular pain and the familiarity with the anterior approach to the vertebral bodies, possibly contributed to the independent development of the ACDF, with small nuances, in different parts of the world.

The Europeans were among the first to publish research on ACDF, although as an abstract in a peer-reviewed journal. Because it was a French journal, the article was unnoticed by most other researchers, especially among non-French speaking authors. However, the manuscript and presentations by Dereymaeker and Mulier certainly contributed to the spread of the ACDF procedure in Europe. Their manuscript was, for example, cited in a Dutch journal in 1966 by Prof. Henk Verbiest, a famous Dutch neurosurgeon.

The arguments then raised against the anterior approach were precisely those that are still used today. Why should the disc be removed if the nerve root is only compressed? Fusion might cause increased stress on the adjacent segment, leading to degeneration. The shape and size of the graft from the iliac crest are the same as those currently used. The discussion about the value of posterior foraminotomy and the consequences of fusion on the adjacent segments had already begun in the 1950s.

Finally, a neurosurgeon and an orthopedic surgeon together describing a surgical technique is noteworthy. With some stretch of the imagination, their partnership could be seen as a first step to the collaboration in spinal care and spinal surgery irrespective of background.

The present contribution fills a gap in the existing literature about ACDF. The description by a Belgian neurosurgeon together with a Belgian orthopedic surgeon is one of the first in world literature. Alongside Cloward, Smith, and Robinson, Albert Dereymaeker and Joseph Cyriel Mulier belong on the list of ACDF pioneers.

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References

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