

The life and work of Adolph Kussmaul 1822–1902: ‘Sword swallows in modern medicine’

Victor Rehnberg and Ed Walters

Early life

The son of a German army surgeon and the oldest of seven children, Adolph Kussmaul (Figure 1) was born in Graben, Germany and went on to study medicine at Heidelberg before himself becoming an army physician, serving in the German-Danish war. After leaving the army in 1849, he was married the following year. Ill health from meningitis precluded clinical work, and he moved to Würzburg to complete his doctorate in 1854, attracted by Virchow who had also worked there. He moved back to Heidelberg, his alma mater, in 1857, becoming Professor of Medicine. He would eventually also accept chairs in Erlangen and Freiburg.

Medical discoveries

During his first year at Heidelberg, he constructed the first ophthalmoscope, but as he had not yet discovered the appropriate optical arrangement, the device did not function properly. Reflecting on it years later he said, ‘It was the best ophthalmoscope at the time. Its only drawback was that it did not work’.

He is credited with the being the first to describe progressive bulbar palsy and polyarteritis nodosa. He also described the paradoxical rise in jugular venous distension during inspiration seen in constrictive pericarditis (Kussmaul’s sign), and the deep, laboured breathing of severe diabetic ketoacidosis (Kussmaul respiration) seen in diabetic coma (Kussmaul coma). Kussmaul’s original description would appear to be of gasping breaths, with reduced frequency, seen only in the latter stages of severe metabolic acidosis. He was also the first to describe dyslexia, calling it ‘word blindness’. Paradoxical jugular venous distention was described in his 1873 paper ‘Concerning Callous Mediastinopericarditis and the Paradoxical Pulse’, following observations made some 20 years previously. In healthy individuals, inspiration generates a negative intra-thoracic pressure, and contraction of the diaphragm increases the intra-abdominal pressure, increasing venous return to the right side of

the heart. The right atrium and right ventricle are compliant and of low pressure, and can accommodate the increased venous return without a significant increase in right atrial pressure. In patients with constrictive pericarditis, the non-compliant pericardium results in a much higher increase in right atrial and jugular venous pressures in the face of the increased systemic venous return in inspiration. In the same paper, Kussmaul describes the paradox of peripheral pulses disappearing during inspiration while the central heartbeat is still present, in patients with chronic pericarditis, known since at least the 17th century.

It was in Freiburg that Kussmaul put his mind to the task of developing a device to visualise the upper gastrointestinal tract. Years earlier in France, Antonin Desormeaux had successfully demonstrated the first human endoscopic device, used to successfully diagnose urethral and bladder diseases in living male patients. Given the difficulty of traversing the oesophagus over the urethra, Kussmaul sought help from an unlikely source, a professional sword swallower.

Having noted their ability to relax the cricopharyngeus and straighten the oesophagus he found them to be ideal subjects to test his new modification of the Desormeaux’s device. Using a 47-cm long, 13-mm diameter rigid device with an external gasoline lamp light source (reflected via mirrors), he was able to visualise the oesophagus and fundus. He went on to demonstrate his new device, together with his sword swallowing associate, at the Society of Naturalists in Freiburg. The sword-swallower introduced the device whilst sat upright before Kussmaul used the device to visualise the oesophagus. However, views with this new device were limited by an inadequate light source and copious secretions and Kussmaul never published a case report. The Mikulicz-Leiter team

Department of Intensive Care, Royal Surrey County Hospital, Guildford, UK

Corresponding author:

Victor Rehnberg, Department of Intensive Care, Royal Surrey County Hospital, Egerton Road, Guildford, Surrey GU2 7XX, UK.
Email: victor_rehnberg@hotmail.com



Figure 1. Adolph Kussmaul.

followed on from his designs in later years and consulted Kussmaul while developing their device which would ultimately become the first clinically useful gastroscope.

He also described a method of balloon dilatation for gastric outflow obstruction, and while he could see future developments, was concerned about how they may be viewed:

whether perhaps bolder species of a distant future will attempt, in such cases through gastrotomy, creation of a gastric fistula and dilatation of the stricture with a knife or probe, to achieve radical successes... who dares today to decide this question? One must fear being softly or loudly ridiculed for just posing it.¹

Other work

In partnership with Ludwig Eichrodt, a lawyer and acquaintance, he published a number of poems under the pseudonym 'Gottlieb Biedermaier'. He went on to coin the phrase 'Biedermeier' to describe the literacy period which was developing in Central Europe at the time, of which the style of his poems were typical. The mood in central Europe was changing at this time. Europe was seeing more political and industrial stability following the end of the Napoleonic wars, and the rise of urbanisation allowed families to concentrate on home-life and a greater interest in home-grown arts.

Later life

His career ended in Strassburg, and he remained living there, until his death at the age of 80 from ischaemic heart disease. He had five children, of whom two had died in early life: one from tetanus, and another from drowning in the Rhine.

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Reference

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