

## Eleventh and twelfth century documentation of surgical goiter cosmesis: a review of contributing literature

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### Abstract

Goiters – abnormal swellings of the thyroid gland at the base of the neck – have been regarded throughout history as cosmetically displeasing, resulting in a large number of proposed treatment ideologies originating from many regions across the globe. However, with threats to surgical practice such as the popularization of conflicting religious ideology and increasing fear of undertaking surgical procedures, early documentation of techniques and methods of surgical thyroid practice were critical in developing thyroid surgery. The current review analyzes Albucasis' *Kitab al-Tasrif* and Frugardii's *Practica Chirurgiae* as eleventh and twelfth century texts of thyroid proceduralism, with a focus on what we may learn from their efforts.

Goiters are abnormal swellings of the thyroid gland – a small, butterfly-shaped gland located in the neck – which may indicate severe endocrine dysfunction.<sup>1</sup> These swellings are typically large, superficial lumps which have long been viewed as cosmetically displeasing. The Chinese first documented appreciation of the goiter in 2700 BCE, treating the abnormal neck masses with topical seaweed and burnt sponge.<sup>2</sup> Originating around 1400 BCE, Indian Ayurvedic medicine first classified goiters (termed *galaganda*) by etiology: *Vataja*, *Kaphaja*, and *Medaja* would later come to be known as hyperthyroidism, hypothyroidism, and thyroidal cysts respectively.<sup>3,4</sup> Surgically, the first non-fatal goiter removal and partial thyroidectomy was performed in 952 CE under opium sedative by Abu Al-Quadim Al-Zahrawi (Latinised to Albucasis), a Moorish physician, using a bag tied around the patient's neck to catch excess blood.<sup>4</sup> In 1170, when Salerno surgeon Roger Frugardii described the complete resection of a goiter, his records became the first extensive

documentation of a successful, complete thyroidectomy.<sup>2</sup> Modern thyroidectomies rely on the use of anatomic landmarking, skilled operative techniques, and highly complex instruments.<sup>5,6</sup> This review aims to characterize and describe the influence of early surgical texts, specifically Albucasis' *Kitab al-Tasrif* and Frugardii's *Practica Chirurgiae* on goiter excision and thyroid surgery.

Thyroid surgery and goiter cosmesis are particularly reliant upon early records due to historical challenges, namely oppression by the Catholic church and a subsequent threat of negative public opinion. By 1200, Catholicism had considerable control over university regulation throughout the Roman empire, and strongly discouraged the practice of surgery, enforcing a policy of *Ecclesia abhorret e sanguine* (“the church beware of blood”).<sup>7</sup> As a result, the practice of highly “bloody” thyroid surgery declined precipitously. Surgery struggled as an unsupported academic practice until its resurgence with the advent of anesthesia in the late eighteenth and early nineteenth centuries.<sup>2</sup> As physicians resumed the practice of operation, the impact of cosmetic changes and significant bleeding made thyroidectomy highly unfavourable, regarded as “a proceeding by no means thought of” and “horrid butchery” throughout major surgical centers.<sup>8</sup> In these uncertain times, pioneers in otorhinolaryngology – Drs. Billroth, Kocher, Halsted, Mayo, Crile, Lahey, and Dunhill – commonly recorded as the “magnificent seven”<sup>8</sup> – relied on the detailed accounts of *Kitab al-Tasrif* and *Practica Chirurgiae* to resume and restore the well-documented science of thyroid surgery.

Albucasis' *Kitab al-Tasrif* (The Method of Medicine) was published around 1000 CE, and is regarded as the guiding text for early surgical procedures worldwide.<sup>9</sup> Albucasis' exposure as a prolific surgeon of eleventh-century Arabia allowed him to convey diverse aspects of surgical practice and contribute to modern thyroid procedures via both classification and proceduralism. His early focus on cosmetic surgery placed particular emphasis on head and neck regions.<sup>9</sup> Primarily, the importance of classification of goiters and other neck masses was evident throughout *Kitab al-Tasrif*, perhaps mostly so in Albucasis' obstinacy that all surgeons and students thoroughly understand the detailed gross anatomy and application to the specific pathology before laying hands on any patient.<sup>10</sup> A direct excerpt from *Kitab al-Tasrif* reads: “Before practicing surgery one should gain knowledge of anatomy and the function of organs so that he will understand their shape, connections, and borders...I have seen someone incise into a swelling in the neck thinking it was an abscess, when it was an aneurysm and the patient dying on the spot.”

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**Figure 1.** Labeled surgical instrument drawings, as recorded in Albucasis' eleventh century surgical text *Kitab Al-Tasrif*. Displaying designs for sharp-tipped surgical probes (from top: 1,4) and deep tissue forceps use in the head and neck (From top: 2,3).<sup>15</sup>

This philosophy reigns strong in surgical training, forming the basis for curricula of many clinical training programs.<sup>11</sup> It also relates well to the Socratic method of teaching through “productive discomfort” – a pedagogical philosophy designed to stimulate critical thinking by drawing out underlying presuppositions – very common in modern-day medical and surgical teaching.<sup>12,13</sup>

In addition, Albucasis' teachings prolifically detailed instruments and technique development for otorhinolaryngological surgery.<sup>3,6</sup> *Kitab Al-Tasrif* contains the first recorded references to cauterization and ligature application, marking the beginning of very commonly used modern techniques for thyroidectomy.<sup>14</sup> Perhaps the most critical contribution from *Kitab Al-Tasrif* was Albucasis' discovery of operating safety within relevant surgical fields. A case excerpt from *Kitab al-Tasrif* outlining laryngeal trauma during a suicide attempt showed Albucasis' ability to draw conclusions from brief surgical encounters: “...I assured myself that neither an artery nor jugular vein had been cut, but air passed out through the wound. So, I hurriedly sutured the wound and treated it until healed. No harm was done to the slave-girl except for a hoarseness in the voice, which was not extreme, and after some days she was restored to the best of health. Hence we may say that laryngotomy is not dangerous.”<sup>15</sup> Albucasis' emphasis on anatomy allowed him to draw rapid conclusions from minimal clinical observations, influencing and convincing readers of his work for centuries thereafter. In addition to technique and surgical safety, Albucasis demonstrated major advancements in tool development, creating new instruments including scalpels and retractors.<sup>15</sup> His detailed drawings and images allowed for re-creation of developed tools, and ultimately, the innovation which would result from the many aspects of Albucasis' work.<sup>15</sup> Overall, through an emphasis on anatomical and pathological knowledge, the advent of cauterization and ligature application in the neck, discovery of safe operating

fields, and scalpel and retractor design and drawings, the recordings of Albucasis in *Kitab al-Tasrif* significantly shaped techniques of thyroid surgery. (Figure 1)

Nearly two centuries later, in 1180, *Practica Chirurgiae* (The Practice of Surgery) was published from the notes and lectures of Roger Frugardii of Salerno. Frugardii's advancements were largely extensions of the Latin translation of *Kitab al-Tasrif*.<sup>7</sup> The most significant additions from *Practica Chirurgiae* came in the field of wound healing and improved cauterization. The most notable adjuncts to Albucasis' work were dressings designed from egg albumin to cover wounds of the neck and end-to-end suturing.<sup>16</sup> Frugardii was also influenced by earlier sources; he referenced seaweed as medical treatment for small goiters of the neck.<sup>16</sup> Overall, Frugardii's extended knowledge in wound healing and medicinal treatments resulted in the first successful and complete thyroidectomy.<sup>2</sup>

What began as simple goiter cosmesis in eleventh-century Arabia has resulted in extensive classification of goiters within the neck, an emphasis on the importance of applied anatomical knowledge in the pedagogy of surgery, the advent of cauterization and ligature application, discovery of safe operating fields of the neck, novel scalpel and retractor designs, and successful interventions for improving wound healing. By the late twelfth century, as initially inspired by cosmetic repair of goiters, Albucasis' *Kitab al-Tasrif* and Frugardii's *Practica Chirurgiae* provided a detailed, accurate, and combined account of the trials and tribulations required to develop a fully successful thyroidectomy procedure. After facing threats of religious oppression and negative public and medical community perception in centuries thereafter, these historical accounts on thyroid proceduralism contributed heavily to the ability for thyroid surgery to be revived and stand as modern practice.

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