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# The Development of Surgical Instruments by Al-Zahrawi and Its Impact on Medical Science in the Golden Age of Islam in the 10th Century AD

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***ABSTRACT***

*Abu al-Qasim al-Zahrawi is one of the most influential figures in the history of Islamic medicine whose contributions continue to shape modern medical science. This article aims to analyze and classify surgical instruments developed by Al-Zahrawi and examine their impact on the development of medical knowledge in the Islamic world and Europe. This study employs the historical method, consisting of heuristics, source criticism, interpretation, and historiography, with data collected through library research using primary and secondary sources. The findings reveal that Al-Zahrawi systematically designed a wide range of surgical instruments, including scalpels, surgical scissors, forceps, suturing tools, cauterization devices, and instruments for gynecology and dentistry. These instruments reflect not only technical innovation but also a sophisticated understanding of anatomy and clinical practice. The discussion highlights that Al-Zahrawi's works laid the foundation for the development of surgery in the Islamic world and significantly influenced European medicine through the translation of al-Tasrif. This article reinforces Al-Zahrawi's position as a pioneer of modern surgical science within the historiography of medicine.*

***Keywords*** : *Al-Zahrawi, Surgical Instruments, Medical Science*

**ABSTRAK**

Abu al-Qasim al-Zahrawi merupakan salah satu tokoh penting dalam sejarah kedokteran Islam yang kontribusinya masih berpengaruh hingga perkembangan ilmu medis modern. Artikel ini bertujuan untuk menganalisis dan mengklasifikasikan alat-alat bedah karya Al-Zahrawi serta menelaah dampaknya terhadap perkembangan ilmu kedokteran di dunia Islam dan Eropa. Penelitian ini menggunakan metode sejarah yang meliputi tahapan heuristik, verifikasi, interpretasi, dan historiografi, dengan teknik pengumpulan data berupa studi kepustakaan terhadap sumber primer dan sekunder. Hasil penelitian menunjukkan bahwa Al-Zahrawi mengembangkan berbagai instrumen bedah yang sistematis dan fungsional, seperti pisau bedah, gunting, forceps, alat jahit luka, hingga instrumen ginekologi dan kedokteran gigi. Alat-alat tersebut tidak hanya mencerminkan kemajuan teknis, tetapi juga menunjukkan pemahaman anatomis dan klinis yang mendalam. Pembahasan menegaskan bahwa karya Al-Zahrawi menjadi fondasi penting bagi perkembangan ilmu bedah di dunia Islam dan berkontribusi signifikan terhadap transmisi pengetahuan medis ke Eropa melalui penerjemahan karya al-Tasrif. Artikel ini menegaskan posisi Al-Zahrawi sebagai pelopor bedah modern dalam historiografi ilmu kedokteran

***Kata Kunci*** : Al-Zahrawi, Instrumen Bedah, Ilmu Kedokteran

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## INTRODUCTION

The history of the development of Islamic medicine during the golden age of Islamic civilization cannot be separated from the role of Muslim scientists who made significant contributions to the advancement of world science. One important figure in the field of medicine and surgery was Abū al-Qāsim Khalaf ibn 'Abbās al-Zahrawī, a Muslim scientist from Andalusia who lived in the 10th century CE.(Anwar, 2023). Al-Zahrawi is widely known for his work al-Taṣrīf, a medical encyclopedia that contains not only medical theory, but also systematic documentation of surgical practices and the development of innovative surgical instruments for his time. Despite Al-Zahrawi's recognized contributions to world medical history, studies of his development of surgical instruments are often placed within the general narrative of Islamic medical history, without a thorough analysis of the innovations, their functions, and their impact on the subsequent development of surgical science. Yet, the surgical instruments Al-Zahrawi designed demonstrated a level of precision, specialization, and anatomical understanding that was far beyond his time, and served as an important reference for surgical practice in Europe for centuries.(Khoirudin et al., 2021).

The main issue that arises is how Al-Zahrawi's contributions to the development of surgical instruments can be understood not only as individual achievements, but as part of the dynamic development of science during the Umayyad II Dynasty in Andalusia. The lack of studies that place Al-Zahrawi's surgical innovations in the context of the history of science has often reduced his important role to that of a supporting figure in the grand narrative of Islamic civilization, rather than as a pioneer of modern surgery. Based on these problems, this study aims to examine Al-Zahrawi's contribution to the development of surgical instruments and analyze its impact on the development of medical science during the golden age of Islam in the 10th century AD.(Khoirudin et al., 2021)The research focus is directed at identifying the types of surgical instruments developed, the context in which they emerged, and their influence on Islamic and Western medical traditions.

Several previous studies that can serve as a basis for identifying research gaps are outlined in the following table.

**Table 2. Al-Zahrawi Research Gap**

| No | Research | Research Focus | Key Findings |
|---|---|---|---|
| 1 | Nouri-Vaskeh et al. (2020), *Al-Zahrawi (936–1013 CE), Icon of Medieval Surgery* | Al-Zahrawi's contributions to neurosurgery | Directly examining Al-Tasrif, particularly the techniques and instruments for cranial and spinal trauma. |
| 2 | Pekesen, Ataman & Vatanoğlu-Lutz (2021), *Abu Al Qasim Al Zahrawi (Albucasis): The father of modern surgery* | An overview of Al-Zahrawi's life and contributions. | Discusses Al-Tasrif, surgical techniques, and various instruments such as scalpels, forceps, retractors, curettes, specula, and cauterization instruments. |
| 3 | Khosravi et al. (2021), *Abu Al Qasim Al Zahrawi (Albucasis) and types of his used surgical knives* | Al-Zahrawi's surgical knife | Identifying various types of knives including their names, shapes, and functions and the reasons why their designs are tailored to specific types of operations. |
| 4 | Karim & Sidik (2021), *Al-Tasrif... Manfaatnya dalam Perkembangan Bidang Perubatan di Eropah* | The Transmission of Al-Tasrif to Europe | It demonstrates three forms of utilization in Europe: translation, use as a medical education reference, and utilization by European medical experts. |
| 5 | Bhattacharya & Bhattacharya (2022), *Abu Al Qasim Al-Zahrawi the Father of Operative Surgery* | Al-Zahrawi's operative contributions | It discusses various innovations such as catgut, tonsillectomy, tracheostomy, cauterization, ligation, and around 200 surgical instruments. |
| 6 | Abdulrazeq et al. (2024), *Al-Zahrawi (936–1013 AD): On the Surgical Treatment of Neurological Disorders* | Neurosurgery | Using the Arabic text of Volume 30 of Al-Tasrif and translating the relevant sections to examine Al-Zahrawi's techniques for cranial and spinal conditions. |

Research on Abu al-Qasim al-Zahrawi and his contributions to the advancement of medicine has been conducted from various perspectives. Nouri-Vaskeh et al. (2020), for instance, examined Al-Zahrawi's contributions to neurosurgery by analyzing the 30th volume of Kitab al-Tasrif, specifically focusing on the management of cranial and spinal injuries and the instruments used in such procedures (Zarrintan et al., 2020). Meanwhile, Pekesen, Ataman, and Vatanoğlu-Lutz (2021) provide a broader overview of Al-Zahrawi's position as a pioneer of surgery by discussing various techniques and instruments, such as scalpels, forceps, retractors, curettes, specula, and cauterization instruments (Pekesen et al., 2021). A more specific study was conducted by Khosravi et al. (2021), who examined the types, characteristics, innovations, and uses of Al-Zahrawi's surgical knives based on Al-Tasrif, demonstrating that the shape of the instruments was adapted to the requirements of the procedure and the type of incision performed (Khosravi et al., 2021). Other research also highlights Al-Zahrawi's contributions to specific fields, such as obstetric practice, through his discussion of various instruments for examination, delivery, and fetal extraction. On the other hand, Karim and Sidik (2021) focus on the utilization of Al-Tasrif in the development of European medicine through the translation process, its use as a reference for medical education, and its incorporation into the works of European medical experts (Karim & @Mat Sidek, 2021). The development of this study was subsequently continued through research examining Al-Zahrawi's contributions to operative surgery, plastic and reconstructive surgery, and neurosurgery.

Based on prior research, it is evident that studies concerning Al-Zahrawi have evolved in several directions ranging from discussions of his general contributions to surgery and analyses of specific instruments (such as scalpels) to research focusing on specialized fields like obstetrics, plastic surgery, and neurosurgery. Studies on Al-Tasrif have also highlighted the work's significance in the transmission of medical knowledge from the Islamic world to Europe. Nevertheless, the scattered nature of these studies suggests there is still room to integrate the discussion of Al-Zahrawi's surgical instruments more systematically based on their medical functions, while simultaneously linking them to the cross-civilizational development of medical science. This research addresses that gap by analyzing and classifying ten surgical instruments representing functions such as cutting, clamping, suturing, cauterization, examination, obstetrics, urology, and dental care. This classification serves not only to demonstrate the diversity of medical technologies developed by Al-Zahrawi but also as a basis for analyzing how innovations The surgical instruments and knowledge documented in Al-Tasrif contributed to the development of medical traditions within the Islamic world and were subsequently transmitted to the Western medical sphere. Thus, this study does not merely position Al-Zahrawi as a figure who produced a range of medical instruments; rather, it analyzes these instruments as part of the process of systematizing surgical knowledge and advancing medical science within the history of intellectual exchange between the Islamic world and Europe.

An analysis of Al-Zahrawi's work and contributions demonstrates that his development of surgical instruments was a product of the Islamic scientific tradition, which prioritizes empirical observation, scientific documentation, and the transmission of knowledge across generations. These surgical innovations not only addressed the medical needs of his time but also formed an important foundation for the development of surgical science in the West, particularly after his works were translated into Latin and adopted by European medical schools.(Anwar, 2023). This research is expected to provide academic benefits by enriching the study of the history of Islamic science, particularly in the fields of medicine and surgery. Furthermore, it is also expected to provide a conceptual contribution to understanding the role of Muslim scientists as key actors in the development of global science, not simply successors to Greek or Roman traditions.(Muthalib, 2025).


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By placing Al-Zahrawi within the historical framework of the development of medical science and innovation, this study seeks to offer a more comprehensive perspective on the role of Islamic civilization in shaping the foundations of modern medical science, while also emphasizing the relevance of the study of Islamic history in contemporary scientific discourse.

## RESEARCH METHOD

This study uses a historical method to examine the contribution of Abu al-Qasim al-Zahrawi in the development of surgical instruments and its impact on medical science during the Golden Age of Islam in the 10th century AD. The historical method was chosen because this study focuses on tracing past events, the thoughts of figures, and the socio-scientific context surrounding the development of Islamic medical science during the Umayyad Dynasty II in Andalusia.

The first stage of the historical method is heuristics, namely the collection of historical sources relevant to the research topic. At this stage, data were obtained through library research using secondary sources. The main secondary source was an academic thesis that comprehensively discusses Al-Zahrawi's contributions, particularly his development of surgical instruments. Supporting secondary sources included scholarly journal articles, books on the history of Islamic medicine, and recent studies on the history of Islamic science published between 2021 and 2025.

The second stage is verification, a process of source criticism to assess the authenticity (external criticism) and credibility of the source's content (internal criticism). At this stage, the accuracy of information regarding the types of surgical instruments, their medical functions, and Al-Zahrawi's claimed influence on the development of medical science, both in the Islamic world and Europe, is assessed. Verification is conducted by comparing various academic sources to ensure data consistency and avoid historiographical bias.

The third stage is interpretation, which is the interpretation of verified historical data. In this stage, data on Al-Zahrawi's surgical innovations are analyzed to understand their scientific significance within the context of the development of Islamic medicine in the 10th century CE. Interpretation is carried out by placing Al-Zahrawi's thoughts and works within the framework of the development of Islamic science and its relationship to later classical and European medical traditions.

The final stage is historiography, which involves compiling the research results into a systematic and analytical historical writing. At this stage, the research findings are presented chronologically and thematically to demonstrate Al-Zahrawi's concrete contributions to the development of surgical instruments and their impact on Islamic and Western medical traditions. The historiography uses a descriptive-analytical approach to present Al-Zahrawi not only as a historical figure but also as a scientist who had a significant influence on the development of global medical science.(Herlina, 2015).

## RESULTS AND DISCUSSION

### A. Analysis And Classification of Al-Zahrawi Surgical Instrumen

The classification of surgical instruments in this study was developed based on their primary medical functions as described in the secondary sources. The classification does not merely reproduce the categorization found in previous studies, but reorganizes the identified instruments according to their functional characteristics, including cutting, grasping, suturing, cauterization, examination, obstetrics, urology, curettage, and dental treatment.


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**Table 2. Classification of Surgical Instruments by Al-Zahrawi**

| No | Name of Surgical Instrument | Main Function | Medical Field |
|---|---|---|---|
| **1.** | Scalpel | Body Tissue Incision | General Surgery |
| **2.** | Surgical Scissors | Cutting Soft Tissue | General Surgery |
| **3.** | Clamping Tool (Forceps) | Holding Back and Clogging the Network | General Surgery |
| **4.** | Wound Suture Tool (Needle & Thread) | Stitching Post-Operative Wounds | Surgery & Traumatology |
| **5.** | Cauterization Tool | Burn the Wound to Stop the Bleeding | General surgery |
| **6.** | Speculum | Opening the Body Cavity | Obsessions & Gynecology |
| **7.** | Fetal Extraction Device | Helping with difficult deliveries | Obsession |
| **8.** | Catheter | Removing Fluids from the Body | Urology |
| **9.** | Scraper Tool (Curetter) | Cleaning Abnormal Network | Surgery & Gynecology |
| **10.** | Dental Care Tools | Treating Oral and Dental Diseases | Dentistry |



**Figure 1. Illustration of a scalpel**

The scalpel is one of the most fundamental instruments in surgical practice, developed by Abu al-Qasim al-Zahrawi. This tool is designed with a sharp edge and high precision, demonstrating Al-Zahrawi's deep understanding of human anatomy and the need for precision in surgical procedures. In contrast to previous medical practices that still relied heavily on crude methods and minimal specialized instruments, Al-Zahrawi's scalpel reflects the shift towards a scientific and systematic approach in 10th-century Islamic medicine. Functionally, this scalpel is used to make incisions in body tissue with the aim of opening access to the organs to be treated. Its sharpness and shape allow the doctor to make a more controlled incision, thereby minimizing tissue damage around the surgical area. This shows that Al-Zahrawi focused not only on the success of the surgical procedure, but also on the safety and recovery of the patient, a concept that remains relevant in modern surgical principles.(Anteng, 2023).

Conceptually, the existence of this scalpel represents a significant advancement in the classification of medical instruments. Al-Zahrawi not only mentioned the instrument but also associated it with a specific function in a particular surgical procedure, as recorded in his monumental work Al-Tasrif. This approach demonstrates that medical practice during the Umayyad II Dynasty had reached a stage of codified medical knowledge, where tools, techniques, and procedures were systematically compiled. In the context of its global influence, the design and function of Al-Zahrawi's scalpel became an important reference for European medicine in the Middle Ages. Through the translation of Al-Tasrif into Latin, the concept of precise scalpel use was adopted and further developed by Western physicians. Thus, Al-Zahrawi's scalpel not only impacted the Islamic world but also laid an important foundation for the development of surgery in Europe (Anjum, 2013).


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**Figure 2. Illustration of surgical scissors**

Surgical scissors are one of the important instruments developed by Abu al-Qasim al-Zahrawi in surgical practice during the Islamic Golden Age of the 10th century AD. The existence of these surgical scissors shows that Al-Zahrawi not only understood the basic needs of medical procedures, but also paid attention to the technical aspects and precision in the surgical process. Surgical scissors were used primarily to cut soft tissue, membranes, and medical bandages with a level of accuracy that was considered advanced for his time. By design, the surgical scissors developed by Al-Zahrawi had two sharp, symmetrical blades with relatively slender tips, allowing doctors to make controlled cuts without damaging the surrounding tissue. This shape reflects a fairly deep understanding of human anatomy, particularly regarding the importance of minimizing trauma to patients during surgical procedures. This innovation was a major differentiator compared to previous cutting tools that tended to be crude and less specific in their functions (Anteng, 2023).

In the context of surgical instrument classification, surgical scissors fall into the category of cutting instruments. However, Al-Zahrawi developed a variety of scissors' functions to suit medical needs, such as cutting dead tissue, opening wounds, or separating specific parts in surgical procedures. This demonstrates a systematic approach to the development of surgical instruments, not simply an adaptation of everyday tools. Al-Zahrawi's contribution to surgical scissors also had a significant impact on the subsequent development of medical science, both in the Islamic world and in Europe. Through his monumental work, Al-Tasrif, the design and function of these scissors were clearly documented, and they were later adopted and modified by European surgeons in the Middle Ages. Thus, Al-Zahrawi's surgical scissors became not only a practical medical tool but also a symbol of the advancement of Islamic medical technology that influenced across civilizations (Pekesen et al., 2021).



**Figure 3. Illustration of Forceps**


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The forceps introduced and developed by Abu al-Qasim al-Zahrawi primarily serve the purpose of grasping, holding, and manipulating body tissue during surgery. In Al-Tasrif, al-Zahrawi describes a variety of forceps of varying shapes and sizes, tailored to specific medical needs, such as clamping blood vessels, removing foreign tissue, and assisting in the extraction of objects or tissue from within the body. In terms of design, al-Zahrawi's forceps demonstrate a deep understanding of human anatomy and simple mechanical principles. The tips of the forceps are serrated or finely grooved to grip tissue without causing excessive damage. The handles are ergonomically designed, allowing the surgeon stable control during surgery, even in procedures requiring high precision. This reflects al-Zahrawi's scientific approach, which focuses not only on function but also on patient safety (Anteng, 2023).

By classification, forceps are included in the group of surgical manipulation and extraction instruments. This tool played a crucial role in the transition of surgical practice from crude methods to more precise and systematic procedures. The presence of forceps allowed surgical procedures to be performed with reduced risk, particularly in controlling bleeding and handling sensitive tissue. Al-Zahrawi's contribution to forceps had a long-lasting impact on the history of medicine. The design principles and function of this tool became the basis for the development of modern forceps, which are still used in medical practice today, both in general surgery, obstetrics, and other specialized fields. Thus, forceps not only represent a technical innovation but also confirm al-Zahrawi's role as a pioneer of surgical instrumentation, a major influence on both Islamic and Western medical traditions (Khan, 2025).



**Figure 4. Illustration of Wound Suturing Tools (Needle & Thread)**

The wound suture device developed by Abu al-Qasim al-Zahrawi demonstrates a high level of understanding of the principles of wound healing and human tissue anatomy.*al-Tasrif*, al-Zahrawi not only described the shape of the surgical needle, but also explained the types of thread materials used, including the use of thread that can be absorbed by the body (such as animal intestines), which is an early concept of*absorbable sutures*in modern surgery. Al-Zahrawi's surgical needles were designed with a curved shape to facilitate tissue penetration without damaging surrounding structures. This design reflects a sophisticated ergonomic and clinical approach, as it allows the surgeon to perform suturing with greater precision, especially in deep wounds and sensitive areas. This demonstrates al-Zahrawi's understanding of the importance of minimizing tissue trauma in surgery (Anteng, 2023).

Furthermore, al-Zahrawi's use of suturing techniques not only aimed to mechanically close wounds, but also to prevent infection and accelerate the healing process. He emphasized the importance of clean tools and precise technique, demonstrating the embryonic concept of antisepsis long before the development of microbiology in Europe. Thus, this suturing tool was not merely a technical instrument, but rather part of a system of surgical knowledge that


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integrated medical theory and clinical practice. Al-Zahrawi's contribution to the development of suturing tools significantly influenced surgical practice in the Islamic world and was later adopted by the Western world through translations of his works.*al-Tasrif*into Latin. The design principles and function of this tool became the basis for the development of suturing instruments in modern medicine, confirming al-Zahrawi's position as an important pioneer in the history of surgery (Amr, 2007).



**Figure 5. Illustration of Cauterization Tool**

The cauterizer is an important surgical instrument developed and systematized by Abu al-Qasim al-Zahrawi in 10th-century medical practice. This instrument is used to stop bleeding, close open wounds, treat infected tissue, and prevent the spread of disease by burning certain tissues.*al-Tasrif*, al-Zahrawi not only described the shape of the cauterization tool, but also provided detailed guidance on the indications for its use, the parts of the body that could be cauterized, and the medical risks that should be avoided.

Technically, the cauterization device developed by al-Zahrawi demonstrated a deep understanding of human anatomy and physiology. He emphasized that cauterization should not be used indiscriminately, but rather as a last resort after other treatment methods have failed (Anteng, 2023)This approach reflects the scientific and ethical stance of Islamic medical practice, which places patient safety as a primary principle. Al-Zahrawi's contributions to the development of cauterization instruments had a long-lasting impact on medicine, both in the Islamic world and in Europe. The cauterization instruments and techniques he designed became important references for European physicians in the Middle Ages after his work was translated into Latin. To this day, the basic principles of cauterization are still used in modern medical practice, albeit with more advanced technology, thus confirming al-Zahrawi's position as a pioneer of scientific and rational surgery in the history of medicine.



**Figure 6. Illustration of a Speculum**


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The speculum is an important surgical instrument developed and perfected by Abu al-Qasim al-Zahrawi, particularly in the fields of surgery and gynecology. It is designed to open body cavities slowly and in a controlled manner, allowing doctors to directly observe the patient's interior without causing unnecessary injury. The opening mechanism of the speculum demonstrates Al-Zahrawi's advanced technical understanding of human anatomy and the principle of caution in medical procedures. Innovatively, Al-Zahrawi's speculum represents a shift in medical practice from speculative methods to direct, anatomically based observation. Before the use of this instrument, examination of body cavities was often limited and high-risk. With the speculum, Al-Zahrawi opened up new possibilities for more accurate diagnosis and surgical procedures, particularly in cases involving the reproductive organs and other internal tracts (Anteng, 2023).

Classified as a diagnostic and exploratory tool, the speculum can be classified as a cutting or suturing tool. Its function is not directly for surgery, but rather as an aid to support further medical procedures. This demonstrates that Al-Zahrawi focused not only on curative measures but also on the pre-surgical stage, namely observation and diagnosis, which are essential foundations of modern medicine. The impact of Al-Zahrawi's speculum is significant, as its basic concepts and forms continue to be used and developed in medical practice today, both in the Islamic world and in Europe. This innovation demonstrates that Al-Zahrawi's contributions were not local and temporary, but rather part of a global scientific legacy that influenced the development of medical technology across civilizations.



**Figure 7. Illustration of Fetal Extraction Tool**

The fetal extraction tool developed by Al-Zahrawi demonstrates a high level of medical understanding of maternal and fetal anatomy and the risks of complex labor. It was specifically designed to handle difficult labor situations, particularly when the fetus is in an abnormal position or when the delivery process threatens the mother's safety. Its tweezers-like shape with blunt, curved tips reflects an effort to minimize soft tissue injury during the procedure. Functionally, this fetal extraction tool marked a significant shift in obstetric practice from a speculative approach to instrument-based medical care. Al-Zahrawi not only introduced the tool but also provided ethical and technical guidance on when and how it should be used, emphasizing that saving the mother's life should be the top priority. This demonstrates that Islamic medical practice at that time recognized the principle of patient safety long before the concept developed in modern medicine (Anteng, 2023).

Historically, Al-Zahrawi's fetal extraction device was the forerunner to the development of obstetric instruments in the Western world, particularly the obstetric forceps, which became widely known in Europe from the Middle Ages to the early modern era. Through translations of Al-Tasrif's work, the concept and design of this device were adapted and further


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developed by European physicians. Thus, Al-Zahrawi's contributions to obstetrics not only impacted the Islamic world but also laid an important foundation for the development of global obstetrics (Matondang & Said, 2023).



**Figure 8. Illustration of a Catheter**

The catheter is an important medical device developed and systematically described by Abu al-Qasim al-Zahrawi in his work, al-Tasrif liman 'Ajiza 'an al-Ta'lif. This device is used to assist the removal of fluids from the body, particularly urine, in patients with urinary tract disorders. The existence of the catheter demonstrates al-Zahrawi's deep understanding of human anatomy and the clinical needs of medical practice.

Technically, the catheter developed by al-Zahrawi was elongated and slender, with a smooth tip designed to minimize injury to internal tissues. The materials used were generally metals such as bronze or copper, which at the time were considered strong and could be cleaned after use. This design reflected al-Zahrawi's concern for the safety and sustainability of medical devices (Anteng, 2023).



**Figure 9. Illustration of a scraper tool (Curetter)**

In terms of classification, catheters are included in the group of limited non-invasive surgical instruments, because although they are inserted into the body, their use does not involve open surgery. This device represents a significant advancement in urological practice during the Islamic Golden Age, and also demonstrates that al-Zahrawi had developed standardized medical procedures, not simply experimental ones. Furthermore, the use of catheters in al-Zahrawi's medical practice had a significant impact on the subsequent


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development of medical science. The basic principles of catheter design and function that he introduced are still used in modern times, albeit with more advanced materials and technology. This confirms that al-Zahrawi's contributions are not only historical but also have scientific continuity in the development of contemporary medical devices.

The curette is an important surgical instrument described by Abu al-Qasim al-Zahrawi in Al-Tasrif, specifically for the removal of abnormal tissue. The curette is designed with a small spoon-shaped or semicircular tip that functions to scrape soft tissue, pathological debris, or dead tissue from certain parts of the body. In the medical context during the Umayyad II Dynasty, this instrument was used primarily for cleaning deep wounds, removing infected tissue, and treating skin diseases and disorders of body cavities, including the uterus and certain tubes. Al-Zahrawi's curette design demonstrates a deep understanding of human anatomy, as its shape allows for controlled scraping without damaging surrounding healthy tissue (Anteng, 2023).

Materially, the scraper is made of strong metal but has a smooth edge, making it safe for use in surgical procedures. This reflects the principle of medical ethics emphasized by Al-Zahrawi, namely minimizing pain and the risk of injury to the patient. The function of the curette was later adopted and developed in modern medical practice, especially in the fields of general surgery and gynecology. The presence of a scraper in Al-Zahrawi's catalog of surgical instruments shows that the world of Islamic medicine was already familiar with the concept of removing pathological tissue as part of the healing process. This concept became an important foundation for the development of surgical techniques in Europe in the Middle Ages, after Al-Zahrawi's work was translated into Latin and widely used in Western medical schools (Karim & Sidik, 2021).



**Figure 10. Illustration of Dental Care Tools**

The dental instruments developed by Abu al-Qasim al-Zahrawi demonstrate significant advances in dentistry during the Umayyad II Dynasty. Based on descriptions in al-Tasrīf liman 'Ajiza 'an al-Ta'līf, Al-Zahrawi designed various specialized instruments for treating dental and oral diseases, such as tooth extraction tools, scalers, and scrapers for infected tissue. The existence of these instruments indicates that dental practice at that time had developed into a distinct branch of surgery, rather than simply a minor component of general medicine. Functionally, Al-Zahrawi's dental instruments were designed with oral anatomy in mind and a high degree of precision. The curved and pointed tips of the instruments demonstrate a deep


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understanding of the position of the teeth and surrounding tissues, allowing for more controlled medical procedures with minimal risk of damage. This reflects Al-Zahrawi's rational and empirical approach, where clinical experience served as the primary basis for developing medical instruments.(Anteng, 2023).

In terms of innovation, Al-Zahrawi's contributions to dental care significantly influenced the development of medicine in the Islamic world and Europe. Many modern dental instruments operate on similar principles to the instruments he designed, particularly in the practice of tooth extraction and cleaning. Through the translation of al-Tasrīf's work into Latin in the Middle Ages, Al-Zahrawi's concepts and designs for dental instruments were adopted by European medical practitioners and became the initial foundation for the development of modern dentistry. Thus, Al-Zahrawi's dental instruments serve not only as medical instruments but also as important evidence of the transfer of knowledge from the Islamic world to the West.

## B. The Impact of Al-Zahrawi Work on Medical Science for the Islamic World and the West (Europe)

Abu al-Qasim al-Zahrawi's monumental work, Kitāb al-Taṣrīf, has had a profound impact on the development of medicine both in the Islamic world and in the West (Europe). Kitāb al-Taṣrīf, a 30-volume medical encyclopedia completed by al-Zahrawi around 1000 CE, is a comprehensive work that not only discusses diseases and treatment techniques, but also describes in detail over 200 surgical instruments with illustrations, an approach that was revolutionary for its time. Al-Zahrawi's emphasis on empirical clinical experience, anatomy, and direct observation led to the treatment of surgery as a systematic and rational discipline, rather than merely a traditional practice or a routine medical ritual. Evidence of this contribution is clear from the fact that Kitāb al-Taṣrīf was later translated into Latin in the 12th century by Gerard of Cremona and was widely used in European universities as a primary reference work for centuries, even into the present day. The implications of this translation and adoption were significant, as they made knowledge previously confined to Islamic medical circles accessible to European scholars and practitioners. This directly contributed to a paradigm shift in medical education in the West, where classical medical texts had previously been heavily dominated by the Greco-Roman tradition. The translation and use of the Kitāb al-Taṣrīf not only enriched European medical curricula but also provided the methodological foundation for modern surgical practice, including the use of more precise instruments and a scientific approach to complex clinical conditions. Beyond its technical influence, al-Zahrawi's work also disseminated principles of medical ethics and a humane doctor-patient relationship, emphasizing the importance of individual case observation in diagnosis and treatment, aspects that would later become fundamental to the modern medical tradition. His work helped elevate surgery from a marginal practice to a respected discipline within the scientific medical community at many centers of learning in the following period (Annajjar, 2010).

Within the Islamic world, Al-Zahrawi's contributions brought about fundamental changes in the way medicine, particularly surgery, was understood and practiced. Before the advent of the Kitab al-Taṣrīf, surgical practice was often viewed as a manual, technical skill lacking the scientific legitimacy of theoretical medicine. Al-Zahrawi succeeded in elevating surgery to a structured scientific discipline through a systematic approach based on clinical experience, direct observation, and the use of specially designed instruments. In this context, the Kitab al-Taṣrīf functioned not only as a textbook but also as a guide to medical practice, integrating medical theory, technique, and ethics. The influence of Al-Zahrawi's work was evident in centers of Islamic scholarship such as Cordoba, Toledo, Cairo, and Baghdad, where the tradition of medical education flourished in the Middle Ages. Medical teaching methods in the Islamic world began to emphasize the importance of clinical practice, hands-on training,


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and the use of surgical instruments appropriate to the patient's condition. This reflected a paradigm shift from speculative medicine to a more empirical and applied approach. In addition, Al-Zahrawi also introduced ethical standards in surgical practice, such as caution in medical procedures, the moral responsibility of physicians, and the importance of patient safety—values that later became integral parts of the Islamic medical tradition. Furthermore, Al-Zahrawi's work strengthened the position of the Islamic world as a center of innovation in medical science during his time. The successful synthesis of Greco-Roman knowledge, local clinical experience, and innovations in surgical instruments demonstrated the ability of Muslim scientists to develop science creatively, rather than simply translating or preserving previous heritage. Thus, Al-Zahrawi's impact on the Islamic world was not only technical, but also intellectual and epistemological, as he established a new framework for thinking about medicine as a rational, humanistic, and practice-based science (Arslan et al., 2014).

The impact of Al-Zahrawi's work extended beyond the Islamic world when the Kitāb al-Taṣrīf was translated into Latin in the 12th century, primarily through translation centers in Toledo and Salerno. In its Latin version, known as the Liber Albucasis, it remained a key reference work in European medical education for centuries. This transmission occurred at a time when Western Europe was still experiencing limitations in the development of surgical science, both in theory and practice. Therefore, the introduction of Al-Zahrawi's work provided a much-needed scientific foundation, particularly in the areas of surgery, obstetrics, and wound care. Early European universities, such as the Universities of Bologna, Montpellier, and Paris, incorporated the Liber Albucasis into their medical curricula. Al-Zahrawi's influence was evident in teaching methods that began to emphasize demonstrations of surgical instruments, operative procedures, and the importance of clinical experience. Many of Al-Zahrawi's surgical concepts, such as the use of sutures for suturing wounds, controlled cauterization techniques, and the classification of surgical instruments, were widely adopted by European physicians and persisted into the early modern period. In fact, some of Al-Zahrawi's illustrations of surgical instruments served as models for European medical instruments in the Middle Ages and early Renaissance. More than a mere transfer of technical knowledge, the reception of Al-Zahrawi's work in Europe demonstrates a significant inter-civilizational intellectual exchange. European medicine did not develop in a vacuum, but was shaped through interaction with the Islamic scientific tradition. In this context, Al-Zahrawi served as an epistemological bridge connecting the classical medical heritage with the renewal of Western medicine. His contributions helped shift surgical practice in Europe from a crude activity performed by surgeons to an academically recognized scientific discipline, thus paving the way for the advancement of modern medicine.

Al-Zahrawi's intellectual legacy did not end with the classical and medieval periods, but continued to exert a lasting influence on the development of medical science into the modern era. Many of Al-Zahrawi's surgical principles remain relevant, particularly in the areas of standardization of medical procedures, patient safety, and an approach based on clinical observation. He emphasized the importance of precision, caution, and an understanding of anatomy before performing surgical procedures, principles that remain the foundation of modern medical ethics and practice. This view demonstrates that Al-Zahrawi was not merely a surgical technician, but a medical thinker who placed science and humanity as one. Al-Zahrawi's concept of surgical instrument classification also contributed significantly to the systematization of surgical science. By grouping instruments based on their function and type of medical procedure, he helped create a methodological approach to surgical practice. This classification pattern later evolved in modern medicine into a standard surgical instrumentation tailored to specific specialties, such as general surgery, gynecology, and dentistry. This demonstrates that Al-Zahrawi's contributions were not only historical but also structural in


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shaping the framework of contemporary medicine. Furthermore, Al-Zahrawi's empirical approach which combined theory with hands-on practice became the forerunner of the scientific method in medicine. He consistently documented his experiences, including successes and failures in medical practice, as learning material for subsequent generations. This tradition of medical record-keeping evolved into a clinical documentation system that is now standard in modern healthcare. Thus, Al-Zahrawi's work can be understood as an important part of the long history of the professionalization of medicine, bridging the classical medical tradition, the Islamic world, and the development of modern medicine globally (Vaskeh, 2021).

Overall, Al-Zahrawi's works occupy a central position in the history of the development of medical science, particularly in the field of surgery, both in the Islamic world and in the West. Through Al-Tasrif, Al-Zahrawi succeeded in transforming previously fragmentary and traditional medical practice into a systematic, structured, and empirically based scientific discipline. His contributions are seen not only in the creation and development of surgical instruments, but also in the formation of a conceptual framework for how medicine should be studied, taught, and practiced. Thus, Al-Zahrawi served as a crucial link between the classical Greco-Roman medical tradition, scientific developments in Islamic civilization, and the birth of modern medicine in Europe. The impact of Al-Zahrawi's thought on the West demonstrates that the process of knowledge transfer from the Islamic world to Europe was not a passive process, but rather an active and productive intellectual dialogue. The adaptation of Al-Zahrawi's work in European medical education demonstrates how Islamic science directly contributed to the scientific revival of the West in the Middle Ages and early Renaissance. In this context, Al-Zahrawi can be understood not only as a major figure in the history of Islamic medicine, but also as a global figure in the history of science. By examining Al-Zahrawi's analysis and classification of surgical instruments and their impact on medical practice across civilizations, this study confirms that the advancement of modern medicine is inextricably linked to the contributions of Muslim scientists during the golden age of Islam. Therefore, the study of Al-Zahrawi is not only relevant for historiographical purposes but also crucial in reconstructing a more just, inclusive, and balanced narrative of the history of science between East and West.

## CONCLUSION

This study demonstrates that Abu al-Qasim al-Zahrawi made a significant contribution to the development of surgical science through the creation and refinement of various medical instruments that were systematic and applicable. Analysis and classification of Al-Zahrawi's surgical instruments demonstrate that these innovations were not solely oriented toward technical functions, but also reflected an anatomical understanding and clinical approach that were advanced for his time. Thus, Al-Zahrawi served not merely as a physician but as a pioneer of scientific surgical methodology.

Furthermore, the findings of this study confirm that Al-Zahrawi's work had a far-reaching impact on the development of medicine in both the Islamic and Western worlds. Through his translation of al-Tasrif into Latin, Al-Zahrawi's surgical thoughts and instruments became key references in European medical education for centuries. This demonstrates that the advancement of modern medicine is inextricably linked to the intellectual contributions of Islamic civilization.

Historiographically, this article strengthens Al-Zahrawi's position as a central figure in the history of global medicine. It is hoped that this research will open up further research into the transmission of medical knowledge across civilizations and the practical influence of the Islamic medical heritage on contemporary medical practice.


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