

Медико-биологические проблемы жизнедеятельности

Научно-практический рецензируемый журнал

№ 3(35)
2025 г.

Учредитель

Государственное учреждение
«Республиканский научно-
практический центр
радиационной медицины
и экологии человека»

Журнал включен в

Перечень научных изданий
Республики Беларусь
для опубликования
диссертационных исследований
по медицинской
и биологической
отраслям науки
(31.12.2009, протокол 25/1)

Журнал зарегистрирован

Министерством информации
Республики Беларусь,
Свид. № 762 от 6.11.2009

Подписано в печать 19.09.25
Формат 60×90/8. Бумага мелованная.
Гарнитура «Times New Roman».
Печать цифровая. Тираж 100 экз.
Усл. печ. л. 14,0. Уч.-изд. л. 8,05.
Зак. 260.

Издатель ГУ «Республиканский
научно-практический центр
радиационной медицины
и экологии человека»
Свидетельство N 1/410 от 14.08.2014

Отпечатано в
КУП «Редакция газеты
«Гомельская праўда»
г. Гомель, ул. Полесская, 17а

ISSN 2074-2088

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Адрес редакции 246040 г. Гомель, ул. Ильича, д. 290,

ГУ «РНПЦ РМ и ЭЧ», редакция журнала

тел (0232) 38-95-00, факс (0232) 37-80-97

http://www.mbp.rcrm.by e-mail: mbp@rcrm.by

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«Республиканский научно-практический центр
радиационной медицины и экологии человека», 2025

№ 3(35)

2025

Medical and Biological Problems of Life Activity

Scientific and Practical Journal

Founder

Republican Research Centre
for Radiation Medicine
and Human Ecology

Journal registration
by the Ministry of information
of Republic of Belarus

Certificate № 762 of 6.11.2009

© Republican Research Centre
for Radiation Medicine
and Human Ecology

ISSN 2074-2088

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THE EVOLUTION OF THYROID SURGERY IN CHINA: FROM OPEN APPROACH TO ENDOSCOPIC MINIMALLY INVASIVE TECHNIQUES

Department of Thyroid and Breast Surgery, The Second Affiliated Hospital of Chengdu Medical College, China National Nuclear Corporation 416 Hospital, Chengdu, China

The development process of thyroid surgery in China is the result of the unremitting efforts and continuous exploration and improvement of generations of thyroid surgeons. Its development process integrates traditional medical wisdom with modern technological innovation, and has undergone a leapfrog development from exploratory surgery to precision and minimally invasive surgery. Traditional thyroidectomy is performed by exposing the thyroid gland through the Kocher incision in the neck. Most patients undergoing thyroid surgery, especially young women, often care about the visible surgical scars on their necks. Recently, with the advancement of technology, surgeons have been able to perform thyroidectomy outside the neck to avoid scarring on the neck. In this article, we summarize our center's experience in thyroid surgery to demonstrate the transition from traditional thyroidectomy to endoscopic surgery and standardized diagnostic and therapeutic approaches in China.

Key words: *thyroid cancer, surgical treatment, minimally invasive surgery, endoscopic surgery*

Introduction

Since the 21st century, the incidence of thyroid disorders in China has exhibited a marked upward trend. Epidemiological data from 2020 indicate that thyroid cancer ranks as the 7th most common malignancy in China and the 4th among female-specific cancers [1]. Surgical treatment remains the most effective treatment method for thyroid cancer. Over the past two decades or so, many modern technologies and equipment have been applied in thyroid surgery, electrocautery devices (e.g., harmonic scalpels) enabled precise hemostasis, intraoperative neuromonitoring (IONM) reduced recurrent laryngeal nerve injury rates, and endoscopic approaches improved cosmetic outcomes [2]. This article comprehensively reviews China's pivotal advancements in thyroid surgery and shares evidence-based clinical management strategies.

1. The Era of Conventional Open Thyroid Surgery

As early as 2700 BC, ancient Chinese medical records documented the use of iodine-rich seaweed for goiter treatment [3]. How-

ever, the ancient surgical methods were primitive and extremely risky, often leading to the death of patients due to massive bleeding or infection. It was not until the end of the 19th century, with the application of anesthesia techniques, anti-infection concepts and hemostasis, as well as the introduction of Professor Theodor Kocher's improved «collar incision» as a classic surgical method to China, that this situation was improved [4]. In the middle and late 20th century, our thyroid surgery center mainly focused on open surgery, emphasizing tumor resection and functional protection. However, the problem of postoperative scarring was prominent, and the scar residue after open surgery became an urgent issue that needed to be addressed in thyroid surgery.

2. The Introduction and Evolution of Endoscopic Minimally Invasive Techniques (1990s-2010s)

With the advancement of surgical methods and the development of minimally invasive surgery, especially as some young female patients have higher requirements for postoperative aesthetics, the acceptance of minimal-

ly invasive surgery is also increasing. Since Gagner completed the first endoscopic-assisted parathyroid surgery in 1996 [5], Dr. Qiu Ming's team in China also accomplished the first domestic transthoracic approach for thyroid adenoma resection in 2002 [6]. Thyroid surgeons are gradually able to perform thyroidectomy through multiple remote external cervical approaches with the assistance of endoscopy, avoiding visible scars on the neck to a certain extent. Since then, endoscopic thyroid surgery has been widely carried out in China, and progress has been made in many aspects such as surgical approaches, surgical indications, surgical operation skills, and surgical instruments. Meanwhile, the endoscopic surgical approaches have become increasingly diverse. For instance, in 2003, Gao Li modified it into a small anterior cervical incision (1.5-2.0cm) and extended it to lateral cervical lymph node dissection [7]. In 2011, Wang Cun-chuan's team pioneered the lateral cervical approach for anterior cervical scarless thyroidectomy, achieving the goal of «scarless neck» [8]. Surgical methods such as the Miccoli technique (and its modifications), Submental approach, Breast/areolar approach (unilateral or bilateral), Axillary approach, Retroauricular approach, Transoral approach, Supraclavicular approach have gradually matured [9]. Our Thyroid Surgery center carried out the first endoscopic thyroid surgery via the thoracic and breast approach as early as 2004, and the first endoscopic thyroid surgery via the transoral approach in 2017. Now, this surgical method of transoral approach has also become one of the most frequently performed endoscopic surgical methods in our center.

3. The Era of Robotic Surgery and Precision Medicine (2010s-Present)

Since China's first robotic thyroid surgery in 2014, the volume of robotic thyroid procedures has increased annually [10]. Robotic systems can now successfully complete various approaches including transoral vestibular and axillary routes for thyroidectomy. Compared to conventional endoscopic thyroid surgery, robotic-assisted procedures of-

fer distinct advantages: improved articulation of endoscopic instruments enables precise manipulation in complex operations (such as mediastinal lymph node dissection), enhanced three-dimensional visualization, and elimination of physiological tremor [11-12]. At present, our thyroid surgery center has not yet acquired robotic equipment to perform these advanced procedures. We must also acknowledge the inherent limitations of robotic surgery, including high costs, the bulky diameter of endoscopes and instruments, and the lack of tactile feedback. Future technological refinements will be necessary to optimize these systems specifically for thyroidectomy procedures, potentially through miniaturization of instruments and development of haptic feedback mechanisms. These improvements could make robotic thyroid surgery more accessible and technically superior in the coming years.

In recent years, thyroid nodule ablation therapy has rapidly developed in China as a surgical alternative. This technique is particularly suitable for patients who decline surgery or have surgical contraindications (e.g., advanced age, multiple comorbidities). It achieves precise tumor inactivation while perfectly preserving thyroid function, truly realizing «incisionless and scarless» treatment [13]. In 2024 alone (figure), our center successfully performed 894 thyroid ablation procedures,

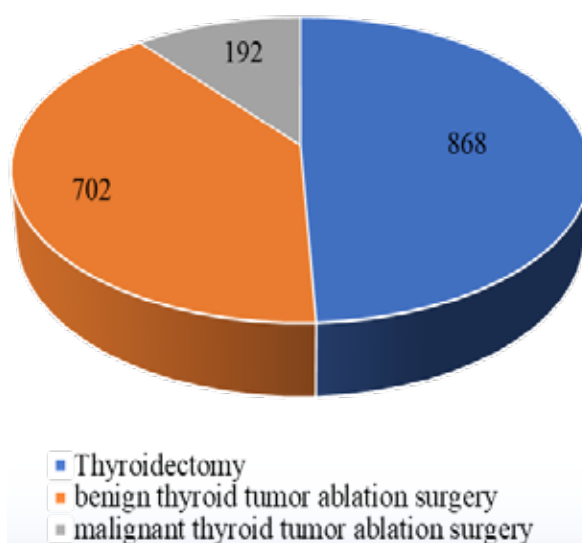


Figure — The number of thyroid surgeries of our center in 2024

including 192 cases of thyroid malignancies. However, the long-term therapeutic efficacy for malignant cases still requires extended follow-up for comprehensive validation.

4. Standardization and Future Trends in Chinese Thyroid Surgery (2020s-Present)

With the widespread adoption of various non-cervical direct-approach surgical techniques, numerous clinical standards and expert consensus documents have been developed, including: “Expert Consensus on Transbreast Endoscopic Thyroid Surgery (2017 Edition)”, “Expert Consensus on Transoral Vestibular Endoscopic Thyroid Surgery (2018 Edition)”. These guidelines have provided clear direction for standardizing endoscopic thyroid surgery practices [14-15]. Emphasis on Multidisciplinary Collaboration and Standardized Postoperative Management. China is actively advancing the establishment of a national thyroid cancer database to promote the standardization of surgical safety and efficacy evaluations. In the future, we may combine artificial intelligence with remote surgery, utilize 3D imaging and virtual reality technology to achieve remote endoscopic operations to solve the problem of uneven medical resources. At the same time, efforts should be made to accelerate the research and development of domestic robots, reduce the cost of surgery and promote the popularization of technology.

Conclusion

Thyroid surgery in China has achieved some accomplishments since the 20th century and has made epoch-making progress in many techniques and concepts. Chinese scholars have made many significant breakthroughs and achievements in thyroid diagnostic techniques, surgical treatment, systemic treatment and basic research. These advancements have provided patients with thyroid diseases with more accurate, safer, more effective and diverse treatment options, and have made the entire process of thyroid diagnosis and treatment more standardized. Meanwhile, we also recognize that there are still many challenges at present, such as the lack of treatment methods for advanced

thyroid cancer and the certain gap in the 5-year survival rate compared with developed countries. However, we firmly believe that through the unremitting efforts of the expert team, we will surely be able to accelerate the process of standardization, scientification, intelligence and effectiveness in the diagnosis and treatment of thyroid cancer. In the future, Chinese thyroid surgery will continue to strive for innovation, research and cooperation to provide patients with better thyroid health management and treatment services.

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Тяньци Хэ, Сюйлян Ся, Чжицянь Цзянь

ЭВОЛЮЦИЯ ХИРУРГИИ ЩИТОВИДНОЙ ЖЕЛЕЗЫ В КИТАЕ: ОТ ОТКРЫТОГО ДОСТУПА К ЭНДОСКОПИЧЕСКИМ МАЛОИНВАЗИВНЫМ МЕТОДАМ

Развитие хирургии щитовидной железы в Китае является результатом неустанных усилий, непрерывных исследований и совершенствования опыта нескольких поколений хирургов. Этот процесс объединяет традиционную медицинскую мудрость с современными технологическими инновациями и претерпел скачок развития от пробной (испытательной) хирургии к прецизионной и малоинвазивной хирургии. Традиционная тиреоидэктомия выполняется путем обнажения щитовидной железы через разрез Кохера на шее. Большинство пациентов, перенесших операцию на щитовидной железе, особенно молодые женщины, часто беспокоятся о видимых послеоперационных рубцах на шее. В последнее время, благодаря развитию технологий, хирурги получили возможность выполнять тиреоидэктомию вне шеи, чтобы избежать образования рубцов. В данной статье мы обобщили опыт нашего центра в области хирургии щитовидной железы, чтобы на этом примере продемонстрировать переход от традиционной тиреоидэктомии к эндоскопической хирургии, а также к стандартизированным диагностическим и лечебным подходам в Китае.

Ключевые слова: рак щитовидной железы, хирургическое лечение, малоинвазивная хирургия, эндоскопическая хирургия

Поступила 30.05.2025