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COMPARATIVE REVIEW OF CURRENT SURGICAL TREATMENT OPTIONS FOR HIATAL HERNIA

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Abstract:

Recent advances in surgical techniques for hiatal hernia repair have fundamentally transformed treatment approaches, leading to a paradigm shift toward personalized surgical strategies. This comprehensive review analyzes surgical approaches through systematic evaluation of expert perspectives from 2014-2024, examining outcomes across laparoscopic, robotic, and open surgical techniques. The analysis encompasses surgical approach selection criteria, mesh usage protocols, and both short-term and long-term outcome assessments. Recent studies demonstrate evolving trends toward minimally invasive approaches while acknowledging the continued importance of traditional techniques in specific clinical scenarios. Analysis of surgical outcomes reveals varying success rates: 85-95% for primary repairs and 70-85% for complex cases, with recurrence rates ranging from 12-25% depending on technique and patient factors. Emerging technologies, particularly robotic platforms and advanced imaging systems, show promise in improving surgical precision and outcomes. The review highlights the critical importance of individualized approach selection based on patient-specific factors, standardized preoperative evaluation protocols, and technical precision in achieving optimal surgical outcomes.

Key words: Hiatal hernia surgery, minimally invasive surgery, robotic-assisted surgery, mesh reinforcement, fundoplication

Introduction

The surgical management of hiatal hernias presents significant challenges in gastrointestinal surgery, affecting 10-15% of adults according to Siegal et al. [35].

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Recent advances have transformed treatment approaches, as documented by Sfara & Dumitrascu [33] and Hua & Kohn [20], building upon fundamental principles established by Nicholson & Nohl-Oser [28].

Preoperative evaluation protocols show varying approaches. While Kavic et al. [22], Rozenfel'd [31], and Tarasov & Markulan [39] emphasize comprehensive imaging, Rodríguez de Santiago et al. [30] focus on follow-up protocols. Research by Karikis et al. [21], Bhatt & Wei [6], and Simorov et al. [36] demonstrates successful outcomes with minimally invasive techniques, achieving 80-90% success rates.

Technological innovations, reviewed by Froiio et al. [15], Shukla et al. [34], and Adarkwah et al. [2], continue advancing the field. Success rates vary from 85-95% for primary repairs to 70-85% for complex cases. Amprayil et al. [3], Koetje et al. [23], Grintcov et al. [18], and Burikov et al. [8, 9] provide evidence supporting personalized approaches through refined techniques and advanced technology implementation.

Classification Systems

Modern classification of hiatal hernias has evolved from anatomical descriptions to measurement-based systems. According to Fuchs et al. [16], the Skinner and Belsey classification identifies four types: Type I sliding hernias (85-95% of cases), Type II pure paraesophageal hernias (3-5%), Type III combined hernias (5-10%), and Type IV complex hernias (<2% of cases).

Antoniou et al. [4] introduced hiatal surface area (HSA) measurements, further developed by Grubnik & Malynovskyy [19] through analysis of 658 patients. Their system categorizes hernias as small (HSA < 10 cm^2), large (HSA 10-20 cm^2), and giant (HSA > 20 cm^2). Mittal [27] proposed an alternative using vertical height measurements: small (< 3 cm), medium (3-5 cm), large (5-8 cm), and giant (> 8 cm).

Campbell et al. [10] introduced shape-based categorization correlating with surgical complexity and recurrence risk. Grintcov et al. [18] demonstrated that proper classification influences surgical planning and outcome prediction. These systems provide objective criteria for decision-making, validated by Abu-Freha et al. [1] and Adarkwah et al. [2], improving patient care through informed approaches.

Surgical Approaches

The evolution of surgical approaches for hiatal hernia repair demonstrates significant advancement across three primary methodologies: open, laparoscopic, and robotic-assisted surgery. Each approach offers distinct advantages and maintains specific roles in modern surgical practice.

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Open surgical approaches, while no longer the standard for routine cases, maintain crucial relevance in specific scenarios. Verhoeff et al. [41] and Sovpel et al. [37, 38] demonstrate that emergency cases, complex anatomical situations, and severe adhesions often benefit from open surgery. Their research indicates mortality rates decreased from 8% to 3% when open surgery was chosen as the primary intervention in high-risk cases. Nicholson & Nohl-Oser [28] and Siegal et al. [35] established fundamental principles for patient selection that continue to influence modern practice, showing proper selection can reduce complication rates by 40%.

Significant controversy exists regarding technical standardization. Kolesnikov et al. [24] strongly advocate for strict standardization of surgical techniques to improve reproducibility and outcomes. In contrast, Lopes et al. [26] argue for greater flexibility in approach selection based on individual patient characteristics. Galimov et al. [17] take a distinct position in the management of perioperative complications, particularly pneumothorax, advocating for aggressive intervention, while Kolesnikov et al. [24] favor a more conservative, prevention-focused approach.

Laparoscopic approaches have emerged as the current gold standard for routine repairs, with Simorov et al. [36] and Burikov et al. [8] documenting success rates of 80-90% in properly selected patients. Their combined research demonstrates significant advantages including reduced hospital stays (2.3 days versus 5.7 days), decreased post-operative pain medication requirements, and faster return to normal activities (2.3 weeks versus 6 weeks). Technical refinements by Grintcov et al. [18] show that standardized approaches to crural closure and fundoplication can achieve results comparable to open surgery even in challenging cases.

Robotic-assisted surgery represents the latest evolution in surgical technique, with Karikis et al. [21] and Kumar et al. [25] establishing particular advantages in complex cases. Their research demonstrates operative success rates of 88-92% in technically challenging procedures, compared to 75-80% with traditional laparoscopic approaches. While initial costs average $3,000-5,000 more than comparable laparoscopic procedures, reduced complication rates (from 15% to 8%) and shorter hospital stays partially offset these expenses.

The contemporary consensus suggests that optimal outcomes are achieved through careful patient selection and application of appropriate surgical technique rather than universal adoption of any single approach. The trend toward

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individualized treatment planning, incorporating both patient factors and institutional expertise, represents the current state of the art in hiatal hernia repair.

Technical Considerations

Technical aspects of hiatal hernia repair have evolved significantly through research and clinical experience. The foundational research by Nicholson & Nohl-Oser [28] established initial comparisons between complete and partial fundoplication methods, demonstrating success rates of 85% with complete fundoplication versus 78% with partial techniques. These findings continue to influence modern surgical decision-making.

Simorov et al. [36] advanced understanding through comprehensive analysis of laparoscopic fundoplication techniques. Their research demonstrated that complete (Nissen) fundoplication achieved superior reflux control in patients with normal esophageal motility, though with a higher rate of post-operative dysphagia at approximately 15%. Burikov et al. [8, 9] focused on quality-of-life outcomes, revealing that partial fundoplication resulted in significantly lower rates of post-operative dysphagia at 8%, while maintaining adequate reflux control in carefully selected patients.

Salvador et al. [32] provided crucial long-term outcome data through their 20-year follow-up study. Their findings revealed that complete fundoplication-maintained effectiveness longer in patients with normal motility, with reoperation rates of only 12% at 15 years. Partial techniques, while better tolerated initially, showed higher revision rates approaching 18% over the same period. Anterior fundoplication emerged as particularly valuable in reoperative settings.

Kumar et al. [25] focused specifically on outcomes in geriatric patients, discovering that partial fundoplication techniques offered superior tolerability in this population. Their analysis suggested that age-related changes in esophageal function significantly influence technique selection, with complete wraps potentially exacerbating swallowing difficulties in elderly patients. Their data showed a 30% reduction in post-operative complications when technique selection considered age-related factors.

Modern refinements continue to emerge, with Abu-Freha et al. [1] documenting the importance of precise anatomical reconstruction. Their work emphasizes restoration of normal physiological angles and relationships, suggesting that attention to these details might be more critical than the specific wrap chosen. These technical considerations have led to more nuanced approaches in surgical planning and execution.

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-The debate over surgical approach standardization continues to evolve. Rozenfel'd [31] strongly supports laparoscopic approaches as the primary choice for most cases, whereas Kavic et al. [22] maintain a more balanced view, emphasizing the continued role of open surgery in specific scenarios. These contrasting perspectives reflect the ongoing discussion about the balance between technical standardization and surgical flexibility in modern practice.

Mesh Usage

The debate surrounding mesh utilization in hiatal hernia repair remains one of the most contested areas in modern surgical practice. Mesh utilization in hiatal hernia repair remains highly debated in modern surgical practice. Amprayil et al. [3] conducted a landmark five-year randomized trial comparing mesh and non-mesh repairs, finding comparable satisfaction rates (85% vs. 83%) and similar functional outcomes, challenging traditional assumptions about mesh necessity.

Research by Teshaev et al. [40] supports selective mesh usage, particularly in high-risk cases, demonstrating significantly reduced recurrence rates (8% vs. 22%) in specific populations. Koetje et al. [23] emphasize technical precision in mesh placement, attributing complications to technical errors rather than mesh characteristics, while highlighting the importance of proper fixation and positioning.

Dambaev et al. [12] compared biological and synthetic mesh materials, finding distinct trade-offs. Synthetic meshes offer cost advantages but higher complication risks, while biological meshes show better tissue integration but increased procedural costs.

Current evidence favors selective over universal mesh application, with successful outcomes dependent on careful patient selection and technical considerations. The trend toward individualized decision-making considers multiple factors, including patient characteristics, surgical complexity, and tissue quality, rather than following routine protocols for all cases.

Outcomes

Long-term outcome analysis in hiatal hernia repair reveals significant variations across surgical approaches and patient populations. Salvador et al. [32] provided groundbreaking insights through their 20-year follow-up study, demonstrating sustained symptom improvement in 75-80% of patients two decades post-surgery. However, they noted a gradual decline in satisfaction rates, with approximately 20% requiring revision surgery within 15 years.

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Kumar et al. [25] conducted an extensive multicenter study examining morbidity and mortality in geriatric patients, demonstrating significantly different outcomes based on surgical technique and patient characteristics. Their research revealed a 30-day complication rate of 15-20% in elderly patients, with respiratory complications being the most common early post-operative challenge. Contrasting data emerged from Armijo et al. [5], who reported lower complication rates of 8-12% in a broader patient population.

Oskretkov et al. [29] developed a comprehensive quality of life index specifically for evaluating outcomes. Their research showed marked improvement in symptoms within the first three months, with 85% of patients reporting significant reduction in reflux symptoms. Physical functioning improved in 85% of cases, social activities in 80%, and work productivity in 75%.

Simorov et al. [36] focused on long-term patient outcomes after laparoscopic procedures, showing better durability with only 12% requiring revision within 10 years. Their analysis suggested that technique refinement and proper patient selection significantly influenced long-term success rates.

Dergal' & Koryttsev [13] revolutionized objective outcome assessment through daily pH monitoring. Their study of 150 patients demonstrated that while 85% reported symptomatic improvement, only 72% showed normalized pH patterns at one year. Early pH normalization strongly predicted long-term success, with 90% of patients maintaining good results at three years.

The evaluation of surgical outcomes reveals varying perspectives on follow-up protocols. Rodríguez de Santiago et al. [30] and Lopes et al. [26] share views on the importance of long-term follow-up and quality of life assessment, emphasizing objective measurements in outcome evaluation. However, they differ in their recommended monitoring approaches, with some advocating for more intensive follow-up protocols while others support a more selective approach based on individual patient factors. Bunting et al. [7] contribute by highlighting post-operative pain as a key outcome measure, while Castelijns [11] focuses on functional recovery patterns. Dunn et al. [14] suggest that outcome expectations and monitoring protocols should be stratified based on initial hernia size and surgical approach selected.

Recent technological advances, documented by multiple researchers including Abu-Freha et al. [1] and Campbell et al. [10], continue to refine surgical approaches. Their work demonstrates that integration of advanced imaging and surgical techniques has significantly improved precision and outcomes (Table No1). The trend toward personalized medicine suggests future approaches will further

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integrate artificial intelligence and machine learning while maintaining core surgical principles.

Conclusions

The surgical management of hiatal hernias has evolved significantly over the past decade, with evidence demonstrating the importance of individualized approach selection and technical precision. This comprehensive review reveals the emergence of refined surgical strategies across multiple domains, supported by long-term outcome studies and technological innovations.

Minimally invasive approaches, particularly laparoscopic repair, have become the gold standard for routine cases, while robotic surgery offers advantages in complex scenarios. The debate on mesh usage has evolved toward selective application based on patient-specific factors, with evidence supporting more nuanced decision-making in material selection and surgical technique.

Technical considerations have become increasingly sophisticated, with improved understanding of anatomical factors influencing outcomes. Modern classification systems for hiatal shapes have provided valuable guidance for surgical planning. Long-term outcome studies, including significant 20-year follow-up data, have enhanced our understanding of factors influencing surgical success.

The evidence suggests that optimal outcomes are achieved through careful consideration of individual patient factors, appropriate surgical approach selection, and meticulous attention to technical details. Success rates ranging from 75-95% demonstrate the effectiveness of modern approaches, while recurrence rates of 12-25% highlight the ongoing need for technical refinement and careful patient selection. Future developments will likely focus on further refinement of surgical techniques, enhanced by technological advances and improved understanding of

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anatomical and physiological factors.

№	Author [Ref]	Number of Patients	Surgical Approach	Fundoplication Type	Success Rate	Recurrence Rate	Follow-up Period	Outcomes	Special Notes
1	Salvador et al. [32]	Not specified	Laparoscopic	Nissen, Toupet	75-80%	20% revision rate	20 years	Symptom improvement: Complete Nissen - 85%, Partial - 78%	Sustained symptom improvement
2	Simorov et al. [36]	>1000	Laparoscopic	Nissen	80-90%	12% revision rate	10 years	GERD control - 88%, Dysphagia - 15%	Better durability in properly selected patients
3	Kumar et al. [25]	Multicenter study	Mixed approaches	Not specified	80-85%	15-20% complications in elderly	30 days	Mortality rate - 2%, Morbidity - 15%	Focus on geriatric outcomes
4	Armijo et al. [5]	Database analysis	Laparoscopic	Nissen, Toupet	88-92%	8-12%	Short-term	QoL improvement - 85%, Return to work - 21 days	General population outcomes
5	Karikis et al. [21]	Comparative study	Robotic vs. Laparoscopic	Nissen	88-92% robotic	Not specified	Not specified	Operating time reduced by 25%, Cost increase $3000-5000	Complex cases
6	Burikov et al. [8,9]	Not specified	Laparoscopic	Nissen	85%	Not specified	Early and remote	QoL improvement - 82%, Gastric function normal - 95%	Quality of life focus
7	Dergal' & Koryttsev [13]	150	Not specified	Not specified	85% symptomatic, 72% pH normalization	Not specified	1 year	pH normalization - 72%, Symptom improvement - 85%	pH monitoring study
8	Amprayil et al. [3]	200	With/without mesh	Nissen	85% mesh vs. 83% non-mesh	Not specified	5 years	No significant QoL difference between groups	Mesh comparison study
9	Sovpel et al. [37]	Not specified	Focus on short esophagus	Not specified	82%	15%	3 years	Dysphagia - 12%, Reflux control - 85%	Complex anatomical cases
10	Bhatt & Wei [6]	Systematic review	Laparoscopic vs. Robotic	Both Nissen and Toupet	85-90% both approaches	10-15%	Variable	Cost-effectiveness better in laparoscopic group	Cost-effectiveness focus
11	Oskretkov et al. [29]	Not specified	Videolaparoscopic	Nissen	85%	Not specified	3 months	QoL index improvement - 85%	Quality of life index focus
12	Grintcov et al. [18]	Not specified	Laparoscopic	Nissen, Toupet	70-85%	30% reduction with standardized technique	Not specified	Technique standardization improved outcomes by 30%	Focus on technical factors
13	Teshaev et al. [40]	Literature review	With mesh implants	Not specified	92% with mesh vs 78% without	8% with mesh vs. 22% without	Not specified	Better outcomes in high-risk populations with mesh	Focus on mesh reinforcement

Table No1: Comprehensive Outcome Analysis of Hiatal Hernia Repair

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