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Review Article

A Comprehensive Review of Inguinal Hernia Management With Saudi Arabia's Clinical Landscape

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Abstract

This comprehensive review explores the management of inguinal hernia (IHN) in Saudi Arabia, focusing on region-specific strategies and clinical approaches. IHNs are prevalent in the male population and are a frequent cause for surgical intervention, often diagnosed through patient history and physical examination. The clinical presentation of IHNs ranges from asymptomatic to severe, life-threatening complications, with mild to moderate pain being the most common symptom. Diagnosis is typically confirmed through physical examination and the Valsalva maneuver, with imaging techniques used, when necessary, particularly in women and recurrent cases. Various repair techniques are discussed, including sutures and mesh, with both open and laparoscopic approaches recommended based on international guidelines. The choice of surgical procedure is influenced by factors such as surgeon expertise, patient characteristics, and resource availability. Recent advances in Saudi Arabia include the increasing use of robotic-assisted surgeries, which offer enhanced precision and minimally invasive options. Additionally, artificial intelligence is being explored for its potential to improve surgical outcomes through advanced data analysis and machine learning. This review underscores the need for tailored strategies to improve IHN management in Saudi Arabia, considering both clinical advancements and socio-economic factors.

INTRODUCTION

A hernia (HN) refers to the protrusion of an organ or adipose tissue through an aponeurotic defect in the surrounding muscle or fascia (Al Judia, H. A., 2018). The incidence of abdominal wall HN is reported at 1.7% for all ages, with a higher prevalence of 4% among individuals older than 45 (Chendjou et al., 2019; Pandya et al., 2021,). In a 2018 study, approximately 11% of Saudi Arabians were found to have abdominal HNs, and this prevalence increased to 38.8% three years later (Aljuaid & Mahfouz, 2021). Men, especially concerning inguinal hernias (IHN), exhibit a higher susceptibility (Yen et al., 2023). Identified risk factors for HN development include pregnancy, constipation, smoking, weightlifting, previous surgery, obesity, and the presence of chronic conditions like diabetes mellitus and bronchial asthma (Albukairi et al., 2018; Lewandowska et al., 2020; Mahfouz et al., 2020).

HN can be asymptomatic, but increased intraabdominal pressure, such as during coughing, bending, or heavy lifting, may lead to swelling, unpleasant bulging, and a sensation of heaviness (Tadbiri et al., 2021). They can be either reducible, where the tissue retracts into the abdomen, or irreducible, when HN components cannot be compressed inside the abdominal cavity. A strangulated HN, where blood flow to the hernial content is compromised, is a significant and life-threatening complication (Albukairi et al., 2018; Alkhalaf et al., 2022; Assakran et al., 2020; Mahfouz et al., 2020,). Studies indicate that being overweight or obese significantly raises the risk of developing an HN compared to steroid use (Albukairi et al., 2018; As- sakran et al., 2020; Mahfouz et al., 2020).

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Various interventional therapy options, including surgery, are available based on the complexity of the HN. For example, certain studies suggest the timing of surgery is critical when repairing abdominal HNs in cirrhotic patients (Alrashid et al., 2022).

Surgeons commonly address ventral or incisional HN and IHNs. HN can be managed and prevented through various methods, including surgery, medications, and trusses. Presently, open surgery and laparoscopy serve as the primary surgical techniques for treating HN. IHNs can be repaired using techniques like herniorrhaphy and herniotomy, involving hernial sac removal. Hernioplasty with a synthetic mesh can be performed. The Lichtenstein tension-free mesh repair method which is the standard of care is widely used for IHN repair, with nearly 800,000 IHN repairs annually in the United States. Re-operation rates for recurrences range between 1 and 15 percent for ventral HN and 24 to 43 percent for IHN (Alsaigh et al., 2023; Zahiri, H. R., et al., 2018). In 2018, a study in Saudi Arabia found a 3.8% prevalence of HN repair, with a reported Saudi population recurrence rate of 1.3% (Almumtin et al., 2020; Alshammari et al., 2018). A 2021 Saudi study revealed more than half of the participants were unaware of HN causes and treatment (Mahfouz et al., 2020).

This study on IHN management in Saudi Arabia fills a crucial research gap due to the increasing prevalence in this demographic. It aims to analyse current strategies, including surgical and non-surgical options. the review aims to improve patient care and treatment outcomes. Furthermore, it seeks to guide future research and clinical practices for a more targeted approach to address inguinal HN challenges within the Saudi healthcare system.

MATERIALS AND METHODS

This comprehensive review aims to analyse and synthesize existing literature and clinical approaches concerning IHN management specifically in the Saudi Arabian context. A comprehensive search was conducted across various databases including PubMed, google scholar, and relevant Saudi Arabian medical journals. Keywords such as ïnguinal hernia¨,ĥernia management,änd S̈audi Arabiaẅere utilized to identify pertinent articles.

Articles were selected based on relevance to IHN management within Saudi Arabia. Inclusion criteria encompassed studies discussing clinical approaches, surgical and non-surgical interventions, risk factors, and outcomes related to IHN in the Saudi population. Studies outside this scope, non-English articles, and those lacking relevance to the subject were excluded. A narrative synthesis approach was used to consolidate and interpret the findings from the selected studies. This methodological framework aimed to ensure a robust exploration of IHN management within the Saudi Arabian context, providing valuable insights and a comprehensive understanding of the subject.

LITERATURE REVIEW RESULTS

Types of HN

A compilation of different types of HN are given below.

- Inguinal HN: The most common type occurs when intestines push through a weak area in the lower abdominal wall, typically in the inguinal canal. In men, it involves the spermatic cord, and in women, it involves the round ligament. (Öberg et al., 2017)
- Hiatal HN: Stomach tissue protrudes through the diaphragm into the chest, affecting abdominal and chest organs, more common in those over 50. (D'Urbano et al., 2023)
- Umbilical HN: Often observed in children, involves intestinal or omentum , protrusions near the belly button, noticeable when the child cries. Usually, self-resolving in young children as abdominal muscles strengthen. (Snitkjær et al., 2023)
- Ventral HN: Tissue bulges through abdominal muscle openings. (Kh et al., 2022)
- Femoral HN: Less common, occurs below the inguinal canal, with visible fatty tissue or bowel. (Kohno et al., 2022)
- Incisional HN: Tissue protrudes through a previous surgical incision in the abdominal wall, a common surgery complication. (Stabilini et al., 2022)
- Epigastric HN: Located above the belly button and below the ribs in the abdomen. (Malysz Oyola et al., 2022)
- Congenital diaphragmatic HN: A severe birth defect involving the incomplete closure of the diaphragm, leading to organ migration into the chest cavity, affecting lung development. (Patel et al., 2022)

IHN strategies and clinical approaches

IHNs typically present as a groin mass that diminishes under minimal pressure or when the patient lies down. Many cases result in mild to moderate discomfort, exacerbated by increased physical activity. They are more prevalent in men aged 40 to 59, with a 9:1 male predominance (Shakil et al., 2020). Direct IHN occur when the HN sac protrudes through the Hassal pack triangle medial to the inferior epigastric vessels, while indirect HN involve the sac passing through the internal inguinal ring beside the spermatic cord and continuing along the canal. IHNs are prone to irreducibility or incarceration, potentially leading to strangulation and obstruction, although strangulation is less common than in femoral HN (Jenkins & O'Dwyer, 2008).

Clinical presentation and diagnosis

IHN can range from being asymptomatic to causing life-threatening strangulation of intra-abdominal con-

Table 1: Other less well-known types of HN

Sr. No.	Name	Description
1	Amyand (Joshi et al., 2022)	The appendix is located within the hernial sac
2	Barth (Mihindou, 2011)	Occurs when the intestinal loops are found between serosa of the abdominal wall and vitelline duct
3	Beclar (Awwad, 2020)	HN occurs involving the femur via saphenous opening
4	Berger (Awwad, 2020)	Cul-de-sac HN (pouch of Douglas)
5	Bochdalek (Nakagawa et al., 2023)	Occurs when HN involves the posterolateral diaphragm
6	Busoga (Mohanty & Rajpal, 2021)	IHN from the Busoga region of Uganda, Ghana and South Sudan where a narrow defect in conjoint tendon or transverse fascia is seen
7	Cloquet (Papanikitas et al., 2008)	Occurs when HN is located behind the femoral blood vessels
8	Cooper (Abraham, 2022)	HN is located in the femoral region but appears biocular having two HN sacs
9	De Garengeot (Gómez-Portilla et al., 2023)	Incarcerated HN located near the femoral region with appendix involvement

Table 2: Other less well-known types of HN

Sr. No.	Name	Description
1	Gibbon (Ambar et al., 2020)	HN appearing with a hydrocele
2	Gruber (Awwad, 2020)	Mesogastric HN appearing internally
3	Grynfeltt (Aza et al., 2023)	Occurs when HN appears through superior lumbar triangle
4	Hesselbach (van den Heuvel et al., 2013)	HN occurs via the cribriform fascia, laterally to the femoral artery involving an intestinal loop
5	Hey (Baker et al., 2014)	Occurs when an oblique IHN is found under three peritoneal coverings
6	Holthouse (Baker et al., 2014)	IHN is located in the groin region appearing outward
7	Kronlein (Fukuhara et al., 2004)	HN appears inguinal as well as preperitoneal
8	Larry (Fukuhara et al., 2004)	Morgagni's HN
9	Laugier (Ates et al., 2011)	HN is located medially in the femoral region between the lacunar ligament gap

tents (Natarajan et al., 2013). The most common symptom is mild to moderate pain (Ramanan et al., 2014). Approximately one-third of individuals with IHN experience no symptoms, and these symptoms may manifest gradually or suddenly, such as when the hernial sac cannot be pushed back into the abdominal cavity. IHN can also be

discovered incidentally during routine physical examinations. Patients with symptoms often endure severe groin pain, and stretching or tearing of tissue around the HN defect can result in sensations like burning or gurgling, which may progress to HN-specific pain. Valsalva maneuvers can exacerbate the pain. The groin may feel heavy or dragging, especially at night or after physical activity (Sabiston & Townsend, 2008). Activities such as lifting, coughing, and straining that increase intra-abdominal pressure can push abdominal contents through the HN defect, causing the size of the bulge to progressively expand. If a patient reports that the bulge disappears when lying down, suspicion of an IHN should arise. IHN can be promptly diagnosed through a thorough physical examination. The examination should commence with a careful inspection of the femoral and inguinal regions for bulges while the patient is standing. The Valsalva procedure should then be performed, with the physician using the right hand to examine the patient's right side and the left hand to evaluate the left side, allowing the assessment of both sides simultaneously. In a supine exam, the physician assesses inguinal hernias, starting at the scrotum and stretching skin with the index finger. Tracing the spermatic cord, the finger moves above the inguinal ligament to the external ring. Positioned above the pubic tubercle, the ring is followed laterally. While the patient coughs, the physician checks for a palpable hernia near the internal ring. Confirmation of an ïmpulseïndicates an inguinal hernia, emphasizing efficiency in identifying hernias through specific anatomical landmarks (Bickley & Szilagyi, 2012).

The Trendelenburg position, where the patient is posi-

Table 3: Other less well-known types of HN

Sr. No.	Name	Description
1	Lederhosen (Awwad, 2020)	Bilaterally occurring HN involving the abdomen of ileum, in suprapubic inferior abdominal wall bulge mimicking the traditional costume "Lederhosen"
2	Littre (Răcăreanu et al., 2023)	HN appears with Meckel's diverticulum
3	Malgaigne (Vukosavljević et al., 2022)	Occurs when HN is seen protruding through the abdominal muscle wall when the patient is made to do leg raises
4	Maydl (Awwad, 2020)	HN appears like the alphabet "W" made up of two bowel loops
5	Morgagni (Gayer et al., 2022)	A retrosternal diaphragmatic HN is seen
6	Mery (Ungureanu et al., 2023)	Occurs when HN protrudes the pelvic floor muscles and fascia
7	Narath (Sinha et al., 2007)	HN occurs behind the femoral blood vessels in patients with congenitally dislocated hip.
8	Pantaloon (Nair et al., 2021)	HN occurs protruding both sides of inferior epigastric vessels
9	Peterson (AlZarooni et al., 2020)	HN involving the small bowel appears via the mesenteric defect from biariatric gastric bypass

Table 4: Other less well-known types of HN

Sr. No.	Name	Description
1	Petit (Alves et al., 2023)	HN involves the Petit's triangle
2	Phantom (Suvarna et al., 2023)	HN appears as a muscle bulge following muscle paralysis
3	Richter (Chorti et al., 2019)	HN is localised to only one wall of the bowel appearing strangulated
4	Rieux (Coroş & Sorlea, 2016)	Retrocaecal HN protruding into a pouch
5	Rokitansky (Ramchandani et al., 2021)	HN appears as a protruding sac of mucous membrane causing muscle fibres to separate
6	Serofini (Papanikitas et al., 2008)	HN is located behind the femoral vessels
7	Spigelian (Shrestha et al., 2023)	HN is seen as a defect of the spigelian fascia
8	Treitz (Lamprou et al., 2022)	Apara duodenal HN is located adjacent to Treitz ligament
9	Velpeau (Ho et al., 2022)	HN is located in front of the femoral vessels

tioned with the head down for up to 15 minutes with light pressure, is a conventional treatment approach. Sudden groin pain could indicate strangulation of the HN, reducing blood flow to the enclosed contents. Symptoms such as redness, nausea, pain, or vomiting should prompt evaluation for strangulation, a surgical emergency (Brunicardi et al., 2014).

Diagnostic imaging

Imaging is typically unnecessary for diagnosing males (Alam et al., 2005; Kraft et al., 2003). However, it is often necessary for women, especially in cases suspected to involve recurring HN, post-repair surgical complications , or when there are other sources of groin pain such as a lump or hydrocele. Ultrasonography (USG) serves as the primary imaging technique with a sensitivity ranging from 33% to 86% and a specificity from 71% to 90% for occult HN. It can aid in diagnosing suspected groin HN that are not evident through clinical examination. When clinical suspicion remains high despite negative USG results, magnetic resonance imaging (MRI) with the Valsalva maneuver could be considered . MRI has a sensitivity of 91% and a specificity of 92% for occult HN, outperforming USG and computed tomography, especially in diagnosing IHN (Miller et al., 2014). Herniography , utilizing contrast media injection, exhibits a sensitivity of 91% and a specificity of 83% for detecting occult HN, proving advantageous over USG and computed tomography (sensitivity = 80%; specificity = 65%), particularly for certain patient subsets (Robinson et al., 2012).

Management

IHN can be repaired through various techniques, which may involve sutures or mesh, an anterior or posterior approach, and either open surgery or laparoscopy. Minimally invasive procedures consistently employ a posterior approach and mesh, while open procedures using sutures typically follow the traditional anterior route. International hernia societies aim to enhance IHN repair outcomes by standardizing care through evidence-based guidelines and recommendations. Out of over

a hundred different repair techniques for inguinal and femoral HN, classified as tissue repair, open mesh repair, and laparo-endoscopic mesh repair, the new International Guidelines of the HN-Surge Group endorse only three techniques: totally extraperitoneal patch plasty , transabdominal preperitoneal patch plasty , and Lichtenstein methods. (Köckerling & Simons, 2018)

Surgeons treating IHNs should offer both an anterior open and laparoscopic approach, as there isn't a universally acknowledged method effective for all cases. According to guidelines, treatment approaches for IHNs should be tailored based on the surgeon's expertise, availability of local and national resources, and individual patient and HN characteristics (Köckerling & Simons, 2018). Well-known suturing techniques include McVay's repair, Bassini repair, Shouldice repair, Lichtenstein technique, and Mesh repairs. Other mesh repairs comprise Plug and patch, Kugel repair, Stoppa repair, and Prolene HN System (Woods & Neumayer, 2008).

The choice of surgical procedure for treating an IHN depends on several factors, such as anaesthesia availability, surgeon preference and training, patient preference, cost, mesh availability, and other considerations. While non-mesh techniques have become less popular, they remain acceptable for specific populations. Mesh methods are favoured due to their lower recurrence rates (Woods & Neumayer, 2008). The 2009 European guideline on hernia repair marked a significant milestone in establishing standardized approaches for different cases. According to this guideline, when dealing with mesh-free hernia repairs, particularly in anterior locations, an open surgical approach is recommended. The open anterior non-mesh approach involves accessing the hernia site through a traditional incision, without the use of mesh for reinforcement. This recommendation is rooted in the consideration of factors such as patient characteristics, hernia size, and the surgeon's expertise. (Bittner et al., 2011; Shakil et al., 2020; Woods & Neumayer, 2008) Laparoscopic procedures offer better post-surgery pain reduction compared to tension-free mesh repair. Common laparoscopic techniques include total extraperitoneal and transabdominal preperitoneal approaches. Both methods involve mesh implantation in the preperitoneal region, but access points differ anatomically. Laparoscopic treatment for groin HN typically leads to improved recovery outcomes compared to open surgery

(Bittner et al., 2011; McCormack et al., 2003; Sajid et al., 2011; Shakil et al., 2020) . In women, laparoscopic techniques are recommended to lower the risk of chronic pain and to avoid missing femoral HN. Additionally, for patients with previous open HN repair, laparoscopic approaches can be used to prevent significant scar tissue formation (Shakil et al., 2020).

A Cochrane review comparing open and laparoscopic repair highlighted that while laparoscopic repair took longer and was associated with a higher incidence of vascular, colonic, or bladder injuries, it offered benefits such as shorter recovery times, quicker resumption of daily activities, reduced pain, and lower recurrence rates. Open repair, conversely, was linked to a higher rate of such injuries (McCormack et al., 2003). According to a systematic review and meta-analysis, laparoscopic HN repair, despite longer operating times, resulted in milder postoperative pain, fewer complications, and faster return to regular activities (Al Chalabi et al., 2015). Another systematic review noted that laparoscopic repair was costlier, more challenging to learn, and posed risks of severe visceral and/or vascular injuries, while open mesh repair was cost-effective, easier to teach, and had no steep learning curve. Open HN repair doesn't demand specialized training and yields comparable outcomes in both specialized and non-specialized centres (Gupta et al., 2014). A 2021 study in Saudi Arabia estimated a 6.3% long-term recurrence rate following laparoscopic repair for IHN (Assakran et al., 2021).

Postoperative care

The current standard of care post IHN repair typically involves general wound management. The required period of inactivity, usually lasting five to eight days, is determined by the surgeon. In a recent case-control study conducted by Bay-Nielsen et al., which assessed convalescence following Lichtenstein repair, it was found that the median duration of absence from work was 7 days. The study concluded that a single day of recovery could be granted without raising recurrence rates. Pain was the most common reason for delayed return to work, reported by 60% of patients, followed by wound issues, reported by 20% (Bay-Nielsen et al., 2001).

RECENT ADVANCES AND RECOMMENDATIONS

Recent advances

In the dynamic landscape of hernia repair, robotic-assisted surgeries have gained prominence globally, and Saudi Arabia is no exception. The utilization of robotic technology in hernia repair procedures has witnessed a notable increase in the country. Robotic hernia repair offers enhanced precision and a minimally invasive approach, allowing for quicker recovery and reduced postoperative discomfort. (Azhar et al., 2019, Rabah & Al-Abdin, 2012) Surgeons in are increasingly adopting this advanced technique, leveraging the benefits of robotic assistance to address inguinal hernias with greater finesse. This progressive shift reflects the commitment of the Saudi healthcare system to embrace cutting-edge technologies, ensuring optimal patient outcomes in the field of hernia management. (Azhar et al., 2019; Gabra & Ageel , 2022; Rabah & Al-Abdin, 2012) Artificial Intelligence has the potential to streamline healthcare analysis and enhance its

quality. The abundance of intraoperative video data enables computer vision and machine learning to train computer programs in interpreting visual data. This technology is not only capable of instrument recognition and skill assessment but also surgical phase recognition. Moreover, it allows the assessment of baseline recognition accuracy, technical evaluation, and advanced performance improvement approaches. In a notable example, Zang C et al. conducted a study establishing the base-line accuracy for surgical phase recognition using 209 robotic-assisted laparoscopic IHN repair videos from 8 surgeons in 2023. Their findings indicated a moderate level of accuracy, although further research is warranted, potentially limiting its use to surgeons with smaller case volumes. Advanced-level courses focusing on extensive investigations of numerous models are poised to be offered due to prospective advancements in this field (Zang et al., 2023).

Recommendation and future directions

The review reveals essential recommendations and future pathways for IHN management in Saudi Arabia. Establishing specialized HN clinics, providing multidisciplinary services, and advanced surgical techniques can significantly enhance patient care. Surgeon training programs, particularly in laparoscopic and robotic approaches, are crucial for improved care standards. Public education campaigns to raise awareness and integrating telemedicine for wider access to specialized care are essential. In addition to that, socioeconomic status and access to healthcare services also play a crucial role in the type and timing of interventions. Financial constraints, health literacy, and geographical access may affect a person's choice of treatment, potentially leading to delayed management or limited access to advanced surgical procedures. Understanding these factors is pivotal in tailoring effective strategies for IHN management in the Saudi Arabian context. Future research must focus on long-term efficacy, cost-effectiveness, patient preferences, and global benchmarking studies to further refine patient-centred care and explore advancements like AI and robotics in HN repair, aiming to enhance outcomes in Saudi Arabia.

CONCLUSION AND RECOMMENDATION

IHN management in Saudi Arabia is an increasingly important facet of healthcare, given the rising incidence of this condition in the region. To address this health challenge effectively, tailored strategies and clinical approaches are essential. These should consider the unique cultural, genetic, lifestyle, and healthcare system factors that characterize Saudi Arabia.

While advancements in surgical techniques, particularly laparoscopy and robotic, offer promising options for HN repair, it is crucial to strike a balance between cost-effectiveness and patient outcomes. Telemedicine has the potential to bridge geographical gaps and enhance access to specialized care, particularly in remote areas. Patient education and awareness campaigns play a vital role in early detection and timely intervention. As Saudi Arabia continues to advance its healthcare system, further research and evidence-based guidelines will be crucial for enhancing the quality of care and optimizing treatment approaches for IHN. The recommendations and future research areas outlined here aim to guide the path forward, ensuring that HN management in Saudi Arabia aligns with international best practices and serves the best interests of both healthcare providers and patients.

AUTHOR CONTRIBUTION

All author contributed equally for the development of this paper.

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