

Ventral Hernia: An Innovative Grading System

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Abstract

Background: Ventral hernia is a complex and progressive condition that may lead to serious complications. However, no specified grading or classifying system is found to categorize the hernia, which leads to clinical complexities and may affect the patient outcome. **Aim:** The general aim of this paper is to build up an easy and comprehensive grading system to categorize ventral hernia. **Methodology:** By carrying out a secondary search over clinical presentation, physical examination, and imaging studies of ventral hernia, a valid grading system is developed. **Results:** Hanoon's grading system is composed of seven grades, grades 1, 2A, 2B, 3A, 3B, 3C, and 4. Each grade entailed different clinical presentations, imaging characteristics, and progressivity of ventral hernia. **Conclusion:** Hanoon's grading system for ventral hernia can be used to solve the clinical complexities of ventral hernia. Also, it can be a step forward in hernia research to build upon.

Keywords

General Surgery, Hernia, Classification, Grading

1. Introduction

Hernia is a condition that occurs at the abdominal site when an organ is pushed into the tissue area because of weakness. The hernia has complicated understanding and different types such as diaphragmatic, umbilical, ventral, and inguinal [1] [2] [3]. The complexity leads to the difficulty of classification, especially in the case of ventral hernia; there is an increased risk of inappropriateness while classifying patients [4]. The hernia conception has evolved numerously in recent years and entails the need for an intensive grading system that can propose a basis for a clear understanding of hernia staging while its progression.

Hernia is known as a progressive condition with disparities in symptoms and signs with anatomical differences. Such changes in this condition symptoms

produce mild, moderate to severe conditions in the case of hernia, the major contributors in the pathogenesis of the hernia are both intrinsic (gender, age, adiposity) and extrinsic factors (smoking, steroids, and undernutrition), which triggers the immune cells to release inflammatory mediators in the extracellular matrix to induce alterations in collagen metabolism rate and lead to loss of cellular integrity [5]. However, understanding the complete mechanism and biology of hernia is complex. The hernia appears with different anatomical presentations and changes, which confuses the clinician to decide on what kind of actions to be carried out to deal with the specific progression of the condition. In addition to such complexities, the grading system holds the potential to resolve the issue. However, understanding such grading/classification system based on progression is required. A hernia is initiated by the changes induced in the abdominal wall, which is shown as an abdominal wall defect in anatomical presentation without bulging or protrusion [6]. Wall defect can be followed by the incidence of reducible hernia, and it usually requires only physical examination to diagnose [7]. The reducible hernia is seen as asymptomatic, and the hernia can be pushed back into the abdominal region; hence the bulging outside the abdominal cavity is prevented [8]. Unlike reducible hernia, the irreducible hernia is more prominent and painful [9]. In this type of hernia, the content cannot be returned to the abdominal cavity as it is incarcerated outside of the abdominal site, and such a hernia may not be managed through physical examination. An irreducible hernia may not be prominent or can be strangulated in severe circumstances. Sometimes, the condition grows chronic without the onset of clear symptoms. However, it might appear as critical bowel symptoms and form strangulation that entails the need for emergency operation [10]. The confined bowel may induce ischemic symptoms to develop at the bowel site. Such alterations show differential classification of irreducible hernia where sub-categories emerge, presenting incarceration, obstruction, and strangulation (Reinke *et al.*, 2020). In more severe complications, hernia takes the form of gangrene with the blackish appearance of a bowel sac [11]. Even though gangrenous hernia comprised a small ratio of hernias found in the case of different types of hernia, such as compared to other progressive stages in ventral hernia, the gangrenous hernia is found only in a 0.4% ratio. However, gangrenes are associated with seeking emergency assistance [12]. All such types of separate features during progression show the way hernia progresses. An abdominal hernia is very prevalent in all age groups and is highly linked with increasing obesity found in today's world. It is most likely that symptoms do not appear even in medical examination sometimes and may lead to chronic severity; each phase of hernia progression requires clinical attention with different measurable steps. Therefore, grading of progressive hernia based on anatomical features is the ultimate need to classify the hernia condition and take either precautionary, preventable, or curable measures. Such types of measures are helpful to prevent the recurrence of hernia as well [13]. Based on the previous discussion, this paper will focus on the classification of ventral hernia and propose a comprehensive grading system for ventral hernias.

2. Research Aim

The general aim is to build up an easy and comprehensive grading/classification system to categorize Ventral hernia, which is based on literature probing the current issue and divided into different objectives.

3. Research Objectives

- 1) To determine different stages of ventral hernia progression.
- 2) To organize the work on ventral wall hernia research and make a common, understandable language between researchers.
- 3) To facilitate the communication between health care providers and document a ventral hernia stage and complication to be used for medico-legal uses.
- 4) To propose a grading system that will help to build up a future guideline in managing abdominal wall hernia.

4. Methods

This is a new grading system will be built upon the basics of physiology, anatomy, and pathology of hernia and will be a combined with the clinical picture and investigation to confirm hernia stage, The research design will involve the study of the hernia grading system through carrying out a literature review In this grading system to emphasize its importance.

We propose a grading system that will incorporate the progression of hernia, its anatomical content, and the complications associated. The study will define each grade comprehensively to allow a complete understanding of the basis of inclusion of such grading foundation [4].

Basis of Hanoon's Grading System:

Commonly known hernias have been classified through their clinical presentation of specific signs and symptoms indicating certain types [14]. Following this concept, we propose a grading system that we will call "Hanoon's" grading system, based upon the study of both clinical presentation and radiological evaluation of hernia anatomical features.

Studying Clinical Presentation:

The hernia has a common symptom, e.g., (pain, swelling vomiting, etc.), and signs, e.g. (coughing impulse), which is initially useful for the diagnosis, here in this grading system, we start with the patient by history taking "symptoms" that we need to gather for initiate a clinical picture about the cases, then will go for a physical examination focusing on hernia examination accompanied by general examination for the overall patient condition. Physical examination is carried out from different positions because the presentation can be different at the respective angle [15].

After history taking and physical examination for the patient, we will have a provisional diagnosis for hernia type and stage the then we will confirm that by the investigation.

Studying Radiological Evaluation:

Physical examination can be suitable for classifying the ventral hernia but not in all cases. Hence, a diagnostic evaluation is a substantial approach to categorizing the progression. It focuses on anatomical features and position differences. Even in the cases of recurrence, radiological diagnosis is suitable to detect persistence [16]. In the present research, we theoretically studied the radiological findings from the literature and evaluated the position and size changes presented on MRI [15]. In clinical practice and when applying this grading system, we can use different imaging modalities to evaluate patient condition e.g. (Ultrasound, Duplex, CT-scan, etc.). Choosing the imaging modality for investigating the patient and reaching the grade can be determined by physician, according to the patient situation e.g., (pregnant women can't be taken to do a CT scan), the physician can make the decision for which radiological investigation he will use. Finally based on both physical and radiological findings we can reach the grade or the class of hernia.

5. Results

By combining symptoms, signs, and radiological findings, we can classify the hernia into formed different grades. As shown in **Table 1**.

6. Discussion

In Hanoon's grading system, we divided ventral hernia according to the progression of its presentation and anatomical content, also we considered the complication that may occur with the hernia, and each grade has its own symptoms, signs, and radiological findings, by gathering all these information, we can classify hernia into grades.

Table 1. Hanoon's ventral hernia grading system.

Grade	Description
1	Established abdominal wall defect without any abdominal content protrusion
2A	Reducible omentum "only omentum protrusion without any intestine" NO evidence * 1 of complications * 1
2B	Reducible <u>intestinal protrusion</u> NO evidence of complications
3A	Irreducible "Incarcerated hernia." NO evidence of complications
3B	Irreducible "Obstructed Hernia" NO evidence of strangulation or gangrene
3C	Irreducible "Strangulated Hernia" NO evidence of gangrene
4	Gangrenous hernia

¹The evidence in this grading system depends on clinical diagnosis/radiological imaging as needed. ²Complications: "obstruction, strangulation or gangrene."

The first grad starts with the presence of abdominal wall defect as the first pathology in forming a hernia, and this defect has no protrusion of any abdominal content. In such cases, no protrusion can lead to a poor examination of ventral hernia [17] that may lead to some difficulties in identifying such a patient in this grad of hernia, without protrusion does not require surgical intervention [18].

The second group in the grading system is “reducible hernia.” In grade 2 a reducible hernia with different sac content, in this grad we do not have any hernia complications, complications can be identified either by clinical presentation/radiological and should be rolled out.

In this grade, we subdivided the hernia into 2 groups according to its content. Grade 2A contains “omentum”, Grade 2B contains intestine, and both grads have no obstruction, strangulation, or gangrene. Research has provided a model for understanding the reducible hernia complexity as well, which also documented the asymptomatic and symptomatic reducible hernia [19]. A significant proportion of patients present with reducible hernia. Patients in the case with asymptomatic reducible hernias are likely to develop symptoms and severity over time, and the situation tends to increase the chances of frequent clinical visits and the need for emergency repair [19]. Reducible hernia shows the presentation of omentum or small bowels that can be potentially pushed back to the abdominal region and is therefore excised easily. However, in reducible hernia cases, if not coordinated effectively in the clinical departments, the signs may further lead to harmful progression. It is very important to gather knowledge about how reducible hernia prevails and what are its clear indications to interfere. From the prospective analysis, it is determined that reducible hernia has been studied very rarely and we are looking for more studies on this side.

In grade 3, we have irreducible hernia which is widely explored in experimental and clinical research. The group has further sub-divisions, including grade 3A “irreducible, incarcerated hernia without obstruction or strangulation” 3B “irreducible obstructed hernia without any evidence of strangulation or gangrene,” and 3C “irreducible and strangulated hernia without gangrene.

Irreducibility is defined by the adherence of mesh at the abdominal site, whereas the obstruction is more prominent with features of pain [20]. It is systematically observed that large irreducible hernia is followed by “loss of domain” which is termed as the difference between hernia size and residual abdominal cavity. The greater the loss of domain ultimately means the large hernia, which is more complicated to be managed [21]. The patient may present the signs of irreducibility without showing obstruction or strangulation [22]. In addition, a strangulated hernia is caused when the ischemia is developed. The ischemia develops because of compromised blood supply to the affected region hence causing strangulation of that region [23]. More so, abdominal pain and vomiting are the secondary symptoms of strangulated ventral hernia [24].

The last grade is the fourth which is termed gangrenous hernia, and it may occur as early as 5 - 6 hours after the onset of ischemia or interrupted blood flow

to the site [25]. This stage can't be determined unless clear evidence is seen for gangrene, e.g. (black discoloration of the intestine). Arterial and venous occlusion is the major cause of the development of gangrene [26]. Gangrenes are formed if the strangulation is not managed and here, we see the progression of the hernia very clearly, which was the idea behind this grading system when the hernia progresses from stage to stage, finally, it will result in complete necrosis. The gangrene has a blackish appearance showing a dead area at the site of incidence [18].

Gangrene formation is one of the significant risk factors for inducing mortality in patients with a ventral hernia. The fact produced the concern for emergency operation in this case because no one should die from the condition [26] [27]. It means that reporting an accurate stage of progression can reduce the chances of mortality. Health care workers need to communicate with each other in an easy manner and we think this will be achieved by such a grading system.

The clinical focus is directed toward predicting operative complexity. Hence, for an understanding of complex condition such as hernias, Hanoon's grading system can facilitate clinical practices and help in decision making.

Finally, each grade of ventral hernia is characterized by different symptoms, signs, and radiological features, hernia is varying from simple abdominal wall defects to serious complications such as gangrenous, we tried here to simplify the hernia types arranging that in a grading system to be easily remembered and used.

We hope by this grading system to contribute to building future guidelines to manage ventral hernia aiming to the best outcome for the patients in a comprehensive scientific manner.

7. Conclusions

Our usual practices in hospitals describe a hernia with a long description based on site, size, content, and complication, which is time-consuming, and sometimes it is confusing. A grading or classification system for ventral hernia will be helpful for the documentation and communication between all healthcare providers as well as the researchers to be a common language.

By using Hanoon's grading system, the clinicians can get early recognition and manage the hernia. The researchers also may explore further knowledge by using the present research as a foundation for ventral hernia.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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