A study of inguinal hernia - on anatomical basis
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Abstract

Background and objectives: Inguinal hernia is very common in males and the predetermination of type of inguinal hernia before surgery may be useful for the treatment plan. Various authors have attempted to classify the types of inguinal hernia based on several criteria. Various modes of classification for inguinal hernia have been described, but none of them seem to be complete, comprehensive and satisfactory because of some lacunae. The types, which are mentioned by some investigators have been turned down or disproved due to some pitfalls and they have been modified and refined. The existence of the spectrum of inguinal hernia with wide scope of divergence appears to be more heterogenous in expression. Hence, an attempt has been made to study the inguinal hernia - on anatomical basis.

Materials & methods: One hundred South Indian male patients with definite inguinal hernia formed material for the study. Measurements were taken with strict aseptic precaution pre and post operatively by using a divider and a metal scale. Results: Out of 100 cases 89 were of indirect type and the remaining are direct type. They are further classified based on several other criteria which are followed by many authors.

Conclusion: Even though several criteria are followed to subdivide the hernia into many subtypes, some lacunae were found and recommendations are given to rectify it.

Key words: classification, direct inguinal hernia, indirect inguinal hernia, inguinal canal, deep inguinal ring, superficial inguinal ring.

Introduction

Among different types of hernia, the inguinal hernia is very common in males. The appearance and progress of inguinal hernia varies in individuals based on their physique, nature of work and duration of hernia. The manifestation of inguinal hernia at the groin has been viewed critically by many investigators and have come out with significant conclusions for classifying them taking into consideration of several criteria like the size of deep inguinal ring\(^1\),\(^2\), the presence of peritoneal sac\(^3\),\(^4\) and the integrity of the posterior wall of the inguinal canal\(^5\). Eventhough, there appears to be a wide deviation with diverse opinion with overlapping of the nomenclature\(^6\),\(^7\) classification of inguinal hernia is a necessary pre requisite for a reliable analysis of different methods of repair\(^8\).

Materials and methods

One hundred South Indian male patients in the age group of 18 - 73 years with uncomplicated inguinal hernia have been examined intensively before and during surgery to determine the type, content, extent of the sac, size of rings, extent of muscles on inguinal ligament, quality of posterior wall of the inguinal canal and the data were recorded to classify the inguinal hernia. All measurements were taken by using a divider and a metal scale with strict aseptic precaution. This study was conducted in the department of Anatomy in collaboration with Surgery department, JIPMER, Pondicherry after obtaining the prior permission from the Institute Research Council and Ethical Committee.

Results

Out of 100 cases of inguinal hernia studied, 89 cases were of indirect type and the remaining were of direct type. In the present study, the inguinal hernia cases have also been classified based on the criteria formed by Gilbert\(^9\), Nyhus\(^10\), Bendavid\(^11\) with the available data collected (Tables1-4).
Most of the indirect hernia cases (63) fit into type I as per Gilbert\textsuperscript{4}, Nyhus\textsuperscript{10} and Rutkow and Robbins\textsuperscript{11} (Table 1 - 3) that is normal or < 2 cm size of deep ring (Table 4) expressing that occurrence of hernia is not related to the size of deep ring.

All direct hernia cases fit into type 4 and 3a (Nyhus)\textsuperscript{13} with posterior wall defect

Discussion

Gilbert\textsuperscript{4} has classified the inguinal hernias on the basis of 1) presence or absence of peritoneal sac 2) size of the deep inguinal ring 3) integrity of posterior wall of inguinal canal and categorized the spectrum into five types namely: 1, 2 & 3 of indirect inguinal hernia and types 4, 5 as of direct. For indirect types 1, 2 & 3 the size of deep inguinal ring was given much importance. The occurrence of inguinal hernia with the tight deep inguinal (dimension not specified) is taken as type 1 (Fig.1). Inguinal hernias with diameter of deep inguinal ring less than 4 cms and more than 4 cms were considered as types 2 & 3 respectively. The types 4 & 5 which are direct inguinal hernias with defective posterior wall are called as type 4 (Fig.2) and direct diverticular defect in supra pubic region is considered as type 5.

Nyhus\textsuperscript{10,11} attempted classifying the condition into four types as 1,2,3 & 4 with three subtypes in type 3. The indirect inguinal hernias taking place in normal sized deep inguinal ring and in individuals with enlarged deep inguinal ring were described as type 1 & 2 respectively. Whereas the type 3, which has been divided with three subtypes as 3a, 3b and 3c with the features of direct, indirect inguinal and femoral hernia respectively. He is of the opinion that 3a which is a direct inguinal hernia with defect primarily in posterior wall alone. The 3b in attributed to weakness of the posterior wall with the dilated deep inguinal ring while 3c are of femoral hernias. Surprisingly, no structural correlation was coined for recurrent inguinal hernias which were described as type 4. 'Bendavid'\textsuperscript{13} introduced the term as 'TSD' classification (T stands for type, S for stage and D for diameter of the deep inguinal ring). The proposed TSD classification has been briefed as type 1 or anterolateral (all indirect inguinal hernias); type 2 or anteromedial (all direct inguinal hernias); then type 3 or posteromedial (femoral hernias); type 4 or posterolateral (prevascular) is of inguinofemoral forms. Each type possessing 3 stages as stage 1, 2 & 3 with definite criteria for each.

For instance, an anterolateral inguinal hernia with deep inguinal ring measuring about 4 cms and the sac extending into the scrotum is abbreviated and expressed as T1 S3 D4. As all anterolateral hernias are of type 1 the T1 is being used. All indirect inguinal hernias which reach the scrotum are regarded as stage 3. On account of this, S3 is being introduced. Finally the diameter of the deep inguinal ring which is described to be of 4 cms, is denoted as D4 which confirms the requirements needed for expression in application and usage of TSD classification.

The complicated inguinal hernias with features of necrosis (N), incarceration (I), adipose tissue (A), sliding form of inguinal hernia (S) and recurrent inguinal hernia (R) are expressed appropriately with abbreviation as denoted with specific alphabets which may also be used and extended in expressing the type of inguinal hernia along with regular coded form of version as an additional feature (if such features exists). It is further specified by giving relevance to recurrence and the number of such episodes. If recurrences have taken place twice it is indicated as 2K and if this were to be applied to the earlier mentioned example of an indirect inguinal hernia of T1 S3 D4, the complete comprehensive condensed terminology would be as T1(2K) S3 D4. However, expression regarding the involvement of the side - so called the laterality, is not expressed in literature. Therefore, it invites further suggestion and modifications.

Without altering the criteria and the requisites which have strictly been enforced by Gilbert\textsuperscript{4}, Rutkow and
Robbins\textsuperscript{12} included two more types of inguinal hernias to make a list of seven types. The direct and indirect type of inguinal hernias as a mixed type in a given individual is regarded as type 6 form whereas type 7 were included as femoral hernia\textsuperscript{13,14}. Thus the groin hernias have been stretched to a wider degree.

In the present study, Gilbert’s\textsuperscript{4} criteria for classification of inguinal hernia has been applied and the following divisions have been observed in 89 cases of indirect inguinal hernia. Of which 63 cases were found to be of type 1 (Fig. 1) and the remaining were of type 2 & 3 (Table 1). All 11 cases of direct inguinal hernia were grouped under type 4 (Fig. 2) and features characteristic of type 5 were found to be absent.

\begin{table}[h]
\centering
\caption{Classification of hernia in the present study according to Gilbert’s Scheme}
\begin{tabular}{|c|c|c|c|}
\hline
Indirect hernia & Direct hernia & & \\
\hline
 & No. of Cases & Type & No. of Cases & \\
\hline
Type 1 & 63 & Type 4 & 11 & \\
Type 2 & 25 & Type 5 & - & \\
Type 3 & 01 & - & - & \\
Total & 89 & Total & 11 & \\
\hline
\end{tabular}
\end{table}

Occurrence of 63 cases of type 1 with deep inguinal ring of less than 2 cms in the local population showing a swing towards a normal sized deep inguinal ring than that of a dilated ring. No changes have been observed on applying the types of classification of Rutkow & Robbins\textsuperscript{12} to the present series (Table 2).

On following the requisites for classification of inguinal hernias put forth by Nyhus\textsuperscript{10}, 89 cases of indirect inguinal hernias were in the form of type 1 & 3b (Table 3). The occurrence of indirect inguinal hernias in enlarged deep ring has been given the significance with or without association of the posterior wall defects. Based on this, all indirect inguinal hernias have been divided into type 2 (hernias with enlarged deep inguinal ring) and type 3b (with enlarged deep inguinal ring and posterior wall defect). As there is no incidence of indirect inguinal hernias with only enlarged deep inguinal ring, there was a total absence of type 2 in the present study. But in type 3b form 26 cases were observed (Table 3).

\begin{table}[h]
\centering
\caption{Classification of hernia in the present study Based on Rutkow & Robbins Scheme}
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline
Indirect hernia & Direct hernia & Mixed hernia & Femoral hernia & \\
Type & No. of cases & Type & No. of cases & Type & No. of cases & Type & No. of cases & \\
\hline
Type 1 & 63 & Type 4 & 11 & Type 6 & - & Type 7 & - & \\
Type 2 & 25 & Type 5 & - & - & - & - & - & \\
Type 3 & 01 & - & - & - & - & - & - & \\
Total & 89 & Total & 11 & - & - & - & - & \\
\hline
\end{tabular}
\end{table}

The more refined form of classification of inguinal hernia has been attempted by Bendavid\textsuperscript{11} on the basis of nature of the inguinal hernia, the grade of the sac position and the diameter of deep inguinal ring as TSD classification. On applying the present data to this all 89 cases of indirect inguinal hernia have been divided...
into cases of indirect inguinal hernia of inguinoscrotal stage (S3) with less than 2 cms size of deep inguinal ring and cases with the size of more than 2 cms as one entity. The other, where indirect inguinal hernia having the inguinal hernial sac confined to the inguinal canal (S1) [not reaching beyond superficial inguinal ring and to the scrotum] with the deep inguinal ring less than 2 cms and more than 2 cms (Table 4).

On following the Bendavid's classification, by clubbing the S1 & S3 cases together, all indirect inguinal hernias with deep inguinal ring of less than 2 cms, the total number of cases falling under this were found to be 60 (Table 4). This is almost equal to type 1 described by Gilbert6.

Interestingly, indirect inguinal hernia occurring in individuals where the deep inguinal ring is more than 2 cms in size with inguinal hernia sac of S3 & S1 stages together, were found to be in 29 cases. This corresponds to the type 2 form of inguinal hernia as described by Gilbert6, Rutkow & Robbins12 where the occurrence was found in 25 cases.
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Fig. 1. Showing 1. Deep inguinal ring allowing the index finger 2. Hernia sac

Fig. 2. Showing 1. Inferior epigastric artery 2. Hernia sac with contents 3. Weak and bulging posterior wall of inguinal canal

Like indirect inguinal hernia TSD classification is also applicable for direct inguinal hernias. As the inguinal hernial sac developing in the Hesselbach's triangle region encroaches towards superficial inguinal ring and later into the scrotum, the description for limitations of the inguinal hernial sac is variously termed as S1, S2 & S3 where S1 stands for the sac at the inguinal canal, in S2 the sac gets limited between superficial inguinal ring and scrotum and in S3 the sac reaches into the scrotum.

In the present study 11 cases of direct inguinal hernia were designated as T2 S1 D<2. All cases of direct inguinal hernias were with normal sized deep inguinal ring and hernial sac extending upto superficial inguinal ring but not beyond it (Table 4).

Conclusion
1. Occurrence of indirect hernia is not related to the increased size of deep ring
2. Posterior wall defect of inguinal canal plays main role in the development of direct inguinal hernia
3. Analysis of functional anatomy of the inguinal canal with classification of inguinal hernias form the basis for treatment and higher cure rate may be anticipated.

Recommendations
1. The TSD type of classification which is accepted as an appropriate scheme of classification requires minor modifications as a result of lack of expression of laterality.
2. Inclusion of the expression of laterality to be introduced along with the conventional TSD classification as TSD L, which is further divided in the following forms as TSD D(L(R)) and TSD L(L) signifying the L(R) & L(L) for involvement of side as right and left.
3. The practical application of this nomenclature for the expression of type of hernia is highly advantageous and beneficial in,
   a. Feeding the data in computers which would facilitate a quick recall of enormous information related to the case studied when required
b. Application of this nomenclature in all teaching Institute Hospitals while making entry in medical records.

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