Changes of important anatomical structures in the inguinal region after a herniorrhaphy: observations during treatment of recurrent hernia using TEP

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Summary
In this study we will describe important anatomical structures in the inguinal region as well as their changes after a herniorrhaphy, as they were seen during treatment of 135 recurrent hernias between 1993 and 2003 using TEP. We observed in most cases an upwardly curving arc-shaped deflection of the inguinal ligament and ileopubic tract, which may be due to tension caused by the attachment of the fascia transversalis and M. obliquus internus to the inguinal ligament. This leads to extension of the femoral canal and the lacuna vasorum. The femoral canal gets wider. This explains the regular occurrence of femoral hernias after a herniorrhaphy. Due to herniorrhaphy, damage is caused to Henle’s loop, the retroparietal spermatic sheath as well as the urogenital fascia. These structures were either only partially or even no longer visible on recurrent operations. The internal inguinal ring has a lip-shaped appearance with a forward tilt in nearly all cases after a herniorrhaphy, whereas with TEP a view into the inguinal canal is practically impossible through the internal inguinal ring. Furthermore, using TEP we often saw especially in large primary hernias with a long medical history tough connective tissue lying upon the inguinal sack. This covering has so far not been described in the literature and is also present on recurrent hernias after a herniorrhaphy.

Key words: anatomical changes, recurrent hernia, inguinal herniorrhaphy, inguinal ligament, retroparietal spermatic sheath.

Introduction
With the work of Bassini the era of modern treatment of the inguinal hernia began. Numerous modifications to the Bassini technique are based on the principle of layer-for-layer sutting of the anatomical structures in this region.

The question we ask is, what changes are caused by the suture tension to the anatomical structures in the inguinal region after an inguinal herniorrhaphy and how does this affect the operative treatment of a hernia as a result of it?

Materials and methods
Between 1993 and 2003 in Grossburgwedel hospital (Region Hannover, Germany) 2452 hernia operations using the total extraperitoneal method (TEP) were...
carried out. 135 patients had recurrent hernias, for which all had previously been operationally treated using inguinal herniorrhaphy (Shouldice or Bassini) (Tab. I).

Of the 135 recurrent operations 84 cases were first time recurrences, 28 cases second recurrences and 23 cases were third or higher recurrences (Tab. II).

Intraoperative photos from video footage were taken and stored digitally. The evaluation of the pictures was made by marking reference points on a monitor in accordance with a visual evaluation scale.

The following anatomical structures were examined for changes:
1. Inguinal ligament
2. Ileopubic tract
3. Henle’s Loop
4. Internal inguinal ring
5. Urogenital fascia
6. Retroparietal spermatic sheath and the route of the spermatic cord

Results

Inguinal ligament

On the laparoscopic photos of primary inguinal hernia we can see that the inguinal ligament takes a straight route from the spina iliaca anterior superior to the pecten ossis pubis (Fig. 1). In recurrent hernias the inguinal ligament takes an arc-shaped route upward induced by tension from the fascia transversalis and the M. obliquus internus (Fig. 2). Because of this an obtuse insertion angle into the inguinal ligament at the pecten ossis pubis is required, which causes enlargement of the femoral canal and the lacuna vasorum.

Ileopubic tract

The ileopubic tract can be seen clearly on primary hernias using TEP. It appears as a structure running
parallel to the inguinal ligament. Similar to the inguinal ligament, the ileopubic tract makes an arc-shaped deflection upwards. Again, we see here enlargement of the femoral canal and the lacuna vasorum.

**Henle's Loop**

Henle’s loop makes a V-shaped loop around the internal inguinal ring thus restricting the spermatic cord within the inguinal ring (Fig. 1, 3). Through contractions of the abdominal muscle, during laparoscopic operations, the function of the loop can clearly be seen. Due to muscular movement Henle’s loop tightens, raising the spermatic cord and thus causing partial closure of the internal inguinal ring. Henle’s loop is no longer definable with recurrent hernia (Fig. 2), thus damaging the muscular closing mechanism.

**Internal inguinal ring**

The internal entrance of the inguinal canal is the internal inguinal ring. In primary inguinal hernias, the ring is round. Because of this, particularly with large indirect hernias, there is laparoscopically a better view inside the inguinal canal laterally from above. With recurrent hernias the internal inguinal ring is no longer round, but stretched into a lip-shape and the entrance of the internal inguinal ring tilts forward. Furthermore, after inguinal herniorrhaphy, the fascia transversalis and the musculus obliquus internus lie, in part, in front and above the internal inguinal ring. This leads to the fact that with recurrent hernias a view inside the inguinal canal through the internal inguinal ring is barely possible (Fig. 3). Only once did we successfully view the inguinal canal of a recurrent hernia. We saw a disfigured arc-shaped inguinal ligament on an unchanged ileopubic tract.

During ultrasound examination of the indirect primary inguinal hernia, the internal inguinal ring becomes wider and larger due to the intraabdominal pressure. Contents of the inguinal sack reach the inguinal canal taking a direct route. The depth of penetration into the inguinal canal depends on the size (length) of the inguinal sack. The entrance into the inguinal canal in indirect recurrent hernias comes from underneath. The fascia transversalis and the musculus obliquus internus, which are pulled down, form a barrier behind which a “sack-like” space develops. This space is the start of the inguinal canal. Contents of the inguinal sack reach the inguinal canal taking an s-shaped route.

**Urogenital fascia**

The urogenital fascia is a structure which lies between the pre- and retroperitoneal space and separates both spaces. A primary hernia manifests itself as a broader, more stable structure. With patients who suffer from a recurrent hernia after inguinal herniorrhaphy, the urogenital fascia is narrow or no longer definable.

**Retroparietal spermatic sheath and the route of the spermatic cord**

With operations using the TEP method, particularly with large and persistent hernias, the retroparietal spermatic sheath has been discovered to be a stable layer which encloses the spermatic vessels laterally and the vas deferens medially. Its exterior as well as its route taken to the muscles are structurally similar. This common “sheath” encloses the spermatic vessels and the vas deferens 2-3 cm prior to entering into the inguinal canal (Fig. 4).

We could not trace this sheath in recurrent hernias and in some cases the spermatic vessels and the vas deferens were separated and were, right up to its entry into the anulus inguinalis internus, enclosed in weak connective tissue. The vas deferens and the spermatic vessels first conjoin at the internal inguinal ring (Fig. 5). Ininguinal hernias often have tough connective tissue which lies upon the inguinal sack. The thickness
of this structure depends on the size of the hernia and the period of medical history (the bigger and longer, the thicker it becomes). This structure is likewise present with recurrences after herniorrhaphy.

**Discussion**

Following the descriptions of the operation techniques of Bassini, Shouldice and other herniorrhaphies the impression was gained that the inguinal ligament is a stable and rigid structure, which does not change under the tension of the attached muscular and fascial structures. This idea cannot be supported. The changes described by us supply the proof that the inguinal ligament is deflected upward in an arc-shaped way thus extending the femoral canal and the lacuna vasorum. In the literature up to fifteen times as many occurrences of femoral hernias after an inguinal herniorrhaphy are described, without ever going into greater detail of this phenomenon [1]. After our observations the reasons for this lie in the described post-operational changes to the inguinal ligament and the iliopubic tract. Similar changes were also presumed in the literature [2, 3]. Apart from these changes we observed an absence of the Henle loop on recurrent hernias. The explanation for this is that mechanical damage is done to the loop during the primary operation, particularly through the application of stitches to the internal inguinal ring. The retroparietal spermatic sheath is described as an extension of the urogenital fascia in the direction of the inguinal canal. It covers the spermatic vessels and the vas deferens and continues into the inguinal canal. [4, 5]. In some cases the retroparietal spermatic sheath reaches the lateral abdominal wall, where it then covers the Arteria and Vena circumflexa ili profunda. In recurrent hernia cases, the retroparietal spermatic sheath is mostly undetectable. We hypothesize that the preparation of the hernia in the inguinal canal leads to the destruction of the retroparietal spermatic sheath, which later causes atrophy of the remaining part of the sheath. However, with recurrent hernias a lower limit of an atrophic fascia spermatica could not be seen. The tough connective tissue which we often saw on large and persistent primary hernias and which lies upon the inguinal sack has so far not been described in the literature. Perhaps the aetiology for this can be clarified in the future. This covering is also present on recurrent hernias after a herniorrhaphy.

**Conclusion**

There are many different operational techniques for the treatment of inguinal hernias. This work represents the substantial changes to the inguinal region after a herniorrhaphy. A disadvantage with herniorrhaphies is the increased occurrence of femoral hernias. In our opinion, the reason for this is the described extension...
of the lacuna vasorum and the femoral canal due to the changes to the inguinal ligament and ileopubic tract. The described changes can be seen as a good reason for tension-free treatment using hernioplastics instead of using herniorrhaphies.

References