

The Diagnosis and Treatments of Inguinal Hernia after Radical Prostatectomy

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ABSTRACT

Prostate cancer (PC) is one of the most common causes of cancer-related death in the world among old men. Radical prostatectomy (RP) is the most common surgical procedure in treatments. However, the complications after RRP always confuse surgeons. Urinary incontinence, impotence, erectile dysfunction frequently have effects on the quality of life after RP on patients occurred PC. Inguinal hernias (IHs) after RP is the most common complication, especially indirect hernias. Thus, patients occurred post-IH are frequently performed secondary surgery. In recent years, urologists have explored different surgical techniques, managements, and preoperatively detections to prevent the development of IH postoperatively. However, the precise mechanism of this procedure occurred is unclear till now. Some retrospective studies have been performed to explore the occurrence of IH post-RRP and prophylactic techniques to prevent or decrease IH occurred after RRP. Disappointingly, there is no one efficient and precise method influenced this procedure occurred. We reviewed recent studies about IH after RP through different approaches to evaluate the development of this procedure.

Keywords: Inguinal Hernia; Radical Retropubic Prostatectomy; Laparoscopic Radical Prostatectomy

1. Introduction

Prostate cancer (PC) is a major worldwide health problem. It is the most commonly diagnosed cancers among old men. The PC incidence is increasing accompanied with increasingly age. Increasing use of prostate-specific antigen (PSA) testing and liberal use of transrectal ultrasound-directed prostate biopsies, prostate cancers are being detected earlier [1,2]. Radical prostatectomy (RP) is today considered gold standard for treating localized PC [3-6]. Radical retropubic prostatectomy (RRP) is primary treatment for clinically organ-confined prostate cancer. The 10-year cancer-specific survival rate for patients with RRP was recently reported to be 96% [7]. Nonetheless, urinary incontinence, impotence, anastomotic stricture, and erectile dysfunction are frequent complications after RRP, and developing a rectourethral fistula following laparoscopic radical prostatectomy [8-10]. Regan *et al.* were the first to report that the rate of post-prostatectomy inguinal hernias (IH) formation within 6 months was 12% in 1996 [11]. The incidence thereafter has been reported range from 6.7% to 38.7% [12-17], while the overall prevalence rate of IH in the general male population has been reported to be nearly 5% [18].

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The precise mechanism of IH after RP is warranted to further investigation. We summarize incidence of IH after RRP, possible factors, or prophylactic procedure to promote the novel techniques and managements.

2. Incidence

Regan *et al.* [11] initially reported 11 patients of 92 who underwent RRP developed inguinal hernias postoperatively. Ten (91%) of the hernias were indirect, one (9%) of the hernias was direct. Akio Matsubara and coworkers recently reported the incidence of postoperative IH after RRP was 10.3% (32 of 311) with a median follow-up of 36 months. Of the 36 hernias, 28 (78%), 2 (6%), and 6 (17%) were indirect, direct, and unknown, respectively [19]. Inguinal hernias mostly were indirect [19,20]. The right-side was dominant in RRP groups [21,22].

Although Regan *et al.* [11] reported all patients presented with a new complaint of asymptomatic groin bulge within 6 months of their prostatectomy. Kentaro Ichioka *et al.* [23] reported 81.8% of postoperative inguinal hernias occurred within 2 years after radical prostatectomy. Fischer and Wanlz [24] recommended that 22% of 77 inguinal hernias after prostatectomy occurred within the first year and 58% within the first 2 years.

To prevent post-radical retropubic prostatectomy in-

guinal hernia, several reports evaluated the incidence of IH through different operation approaches and managements. Shunsuke Yoshimine *et al.* [22] compared extraperitoneal approach and transperitoneal approach induced postoperative inguinal hernia after laparoscopic radical prostatectomy (LRP). The results showed IH occurred in 4 (4.9%) of the 81 patients in the transperitoneal approach group, and in 37 (9.0%) of the 412 patients in the extraperitoneal approach group. The overall incidence of inguinal hernia was 8.3% (41 of 493 patients). Minh Do, M. D. [25] performed 93 patients with endoscopic extraperitoneal radical prostatectomy (EERPE) and observed no hernia recurrence during the follow-up period. Jungle Chi-Hsiang Wu and Johan Stranne *et al.* [26-28] suggested a lower incidence of postoperative IH after robot-assisted laparoscopic radical prostatectomy (RALP). Akio *et al.* [19] compared IH after radical perineal prostatectomy (RPP) and RRP, and the incidence was 1.8% (5 of 285) and 10.3% (32 of 311) for RPP and RRP, respectively ($P < 0.0001$). The rate showed by KENTARO ICHIOKA *et al.* was 21.3%, 11.4%, 5.4%, respectively. The incidence of IH after radical prostatectomy was rather higher than other two groups [23]. However, on the late report in 2007, the incidence of patients operated with open prostatectomy for benign prostate hyperplasia, pelvic lymph node dissection for staging of prostate cancer, or cystectomy for bladder cancer was no statistically significant [29]. We can conclude that different approaches influenced the incidence of IH after radical prostatectomy and EERPE, RALP, RPP could effectively reduce the IH formation after radical prostatectomy.

3. Risk Factors

Although a lot of studies have accessed the risk factors for post-RRP inguinal hernias, a comparison of these is difficult because of factors, the variability in the risk factors evaluated, and varying study methods. However, some investigators postulated it was possible miss some hernias on the preoperative physical examination due to studies were retrospective. In present studies, several clinical factors have been reported to be associated with the inguinal hernia formation postoperatively. Increasing age [30-33], body mass index less than 23 kg/m^2 [23,34], a history of smoking [35], bladder neck contracture (BNC) [30], history of inguinal hernia, [23,30,31,35], and wound-related problems [35] were identified as significant independent risk factors for the inguinal hernias formation after RP. Previous hernia repair was also a risk factor for the development of IH after RP, with a 3.9-fold increased risk reported by Farhang Rabbani, *et al.* [36]. Although still others did not identify previous hernia repair as a risk factor [12]. Lodding *et al.* [30] reported the 2.8-fold increased risk of post-RP inguinal hernia in patients with

BNC was consistent with the increased rate of IH. However, Stranne J. *et al.* [31] did not consider BNC as a risk factor in their cohort. Farhang Rabbani, *et al.* [36] supposed the increased intraabdominal pressure from obstruction from the BNC was probably responsible for the increased risk of IH after RP in patients with BNC. Stranne *et al.* reported simultaneously pelvic lymph node dissection (PLND), postoperative anastomotic stricture and duration of surgery were not significant risk factors, however, age increases the risk of post-RRP inguinal hernia formation [37]. Some recent researches recommended the surgical time also maybe a major influenced factor [38,39].

The lower mid-line incision has been suggested to be a causative cause [30,40]. CHIA-MING *et al.* [35] reported the wound-related problems may be one risk factor of post-RRP IH. A postoperative IH incidence of only 2.9% in a group of 272 patients where RRP was performed through a so called "minilaparotomy" incision of only 6 cm reported by Koie *et al.* [12]. Matsubara *et al.* [19] also reported an IH incidence of 1.8% after RPP, consequently there was no abdominal incision at all, where the whole procedure is performed through a perineal incision. The length of the abdominal incision is of great importance for the postoperative IH formation [12,27]. The development of IH after RRP is likely induced by multi-factor preoperatively described above.

4. Mechanism

The precise mechanism of IH occurred after RP is still unknown. Regan *et al.* suggested two factors for the development of an inguinal hernia: a patent processus vaginalis and a defect in the internal ring. The internal ring has been postulated to act like a U-shaped valve and that prior to increases in abdominal pressure it acts like a shutter to prevent herniation, the so-called shutter mechanism. Older patients are specifically prone to increased IH, due a small defect in the inguinal ring is unawares enlarged or the nerve supply to the shutter mechanism is injured [11].

The site, myopectineal orifice, is defined superiorly by the internal oblique and transversus abdominus muscles, laterally by the iliopsoas muscle, medially by the rectus muscle, and inferiorly by the pectineal line of the pubis. The orifice is traversed by the spermatic cord and femoral vessels and sealed on its inner surface by the transversalis fascia. Injury of the transversalis fascia may induce failure of the shutter mechanism, which is produced by the transversus aponeurotic arch when the transversus abdominal muscle and internal oblique muscles are stretched. This mechanism strengths the internal ring and plays an important role in maintaining the visceral sac in the myopectineal orifice [23,37].

In 2004, Ichioka *et al.* reported the procedure of exposing of the external iliac vein in PLND during radical prostatectomy often exposes the myopectineal orifice. Therefore, the procedure may injure myopectineal orifice and herniation is more susceptible to development. Furthermore, the vas deferens were cut when the prostate and seminal vesicles were finally exposed when performed radical prostatectomy with a retrograde approach. Thus, the vas deferens probably have been retracted during all radical prostatectomy procedures, also weakening the point of entrance of the vas deferens into the abdominal wall. They postulated prolonged use of the retractor might further damage the fascia, leading to a greater incidence of postoperative IH after radical prostatectomy than that after staging PLND and the postoperative abdominal pressure may affect the incidence of IH [23]. Similar reported by Ichioka *et al.* [40].

Some studies have suggested the incidence of radical prostatectomy-related inguinal hernia (RPRIH) was lower in cystoprostatectomy group than RRP group [23, 41]. Hypothetically, this may have been associated with the extent of the injury to the transversalis fascia, because this injury will induce failure of the so-called shutter mechanism produced by the transverse aponeurotic arch when the transverse abdominal muscle and internal oblique muscles are stretched, which reinforces the groin [21,23,42]. The damage to the transversalis fascia may be less during radical cystoprostatectomy than during RRP [41]. However, Abe *et al.* regarded stretching injury of the groin region by retraction of the vasa deferentia during prostatectomy as a reasonable explanation, because the incidence of IH after RRP was almost equal to that after LRP [21,37,43]. Several reports have recommended that injury to the abdominal wall structures caused by surgical procedures may trigger subclinical IH that are present before surgery to develop into clinically apparent, bulging ones [35,40,44,45].

In 2007, Akio *et al.* compared the incidence of IH after RRP and RPP, they discovered the figure of RPP was significantly lower than the former. However, opening of the endopelvic fascia (EPF) appears to be less implicated in IH development, where both the EPF and the dorsal vein complex were left intact in standard RPP, surgical technique was used whereby the EPF was opened followed by division of the dorsal vein complex in modified RPP. However, there was no significantly different in hernia incidence between the standard technique and the modified one [19].

A interesting observation occurred in the laterality of the IH formation. A right-side IH occurred was significantly more often than a left side hernia. Abe *et al.* [21] reported the right-side dominance of post operative IH in open RRP group. They suggested that a surgeon who stands on the left side of the patient may result in exces-

sive dissection in the right groin area. However, surgeons usually do not retract the vasa deferentia during LRP. Furthermore, Sekita *et al.* [13] reported that subclinical IH was found in 25% of RRP patients and the existence of subclinical IH was primarily right-sided (75%). This could explain the right-side dominance of postoperative IH. However, this is also not a sufficient explanation for the right-side IH dominance. Further investigations were needed to explain why the development of IH in right side is always more than left side.

5. Prophylactic Procedures

The high incidence of IH is a serious challenge for urologists. Novel prophylactic procedures are urgently needed to prevent the occurrence of IH postoperatively. Johan *et al.* [27] compared the incidence of IH after RRP and RALP, the results was 12.2%, 5.8%, respectively. They suggested that there was significantly difference between the RRP group and the RALP group, and RALP may lower the risks of recurrence. Jungle *et al.* [26] performed robot-assisted laparoscopic hernioplasty (RALH) during RALP. Therefore, the result was disappointed while there was no significant difference between the RALP group and RALP combined with RALH. Several studies have reported the incidence of IH after RRP is higher than LRP [21,27]. To investigate whether the difference approach of LRP could influence the incidence of IH, Shunsuke *et al.* [22] compared the development of IH of the extraperitoneal approach (EPA) and transperitoneal approach (TPA) after LRP, they discovered the incidence of IH in the EPA group was significantly greater than TPA group. However, in 2010 Brian M. Lin *et al.* [46] reported the incidence of IH after LRP was similar, in spite of the laparoscopic approach.

To reduce the incidence of IH formation, surgeons tried to establish novel and simple methods, managements of preventing post-retropubic prostatectomy inguinal hernia. Yasuyuki S. *et al.* [47] dissected the peritoneum at the internal inguinal ring and isolated the spermatic cord from surrounding the peritoneum, beginning at the internal inguinal ring and proceeding towards the iliac fossa, using the preperitoneal approach. They observed the incidence of IH in the prophylactic procedure group (1.6%) was significantly lower than that in the conventional RRP group (50%) during a median follow-up period of 41 months indicating the efficacy of the procedure. Yasuhisa F. *et al.* [48] isolated the spermatic cords and dissected the vas deferens, leading to destruction of the spermatic sheath covering the spermatic cord. The results showed that this measure was safe and effective to prevent IH formation after RRP. Kazumi Taguchi *et al.* [43] released the bilateral spermatic cord from the peritoneum without placing mesh sheets and manually

without ligating the vaginal process of the peritoneum at least 5 cm from the abdominal wall. Thus, there was no IH occurred in the procedure group. In conclusion, isolating the spermatic cord may be a sufficient method to prevent IH post-RRP. However, longer-term observation of more patients are warranted to reveal whether the prophylactic method could efficiently prevent the development of IH after RRP.

In 2004, TEBER *et al.* [49] indicated performing LRP plus repair of IH using prosthetic mesh or LRP was no significantly difference in the incidence of IH. Either the transperitoneal or extraperitoneal approach is feasible. In recent studies, many investigators showed the similar conclusion [25,37,50]. Although, the laparoscopic totally extraperitoneal after radical prostatectomy could be influenced by surgeons, skill and experience recommended by J.-L. *et al.* [51].

Lepor *et al.* [52] detected an inguinal hernia by physical examination and routine abdominal computed tomography preoperatively in 1130 patients, consequently, 146 (13%) had a preoperative inguinal hernia. The sensitivity was 96.3% and 42.5%, respectively. All candidates for open RRP should undergo a careful physical examination to identify asymptomatic inguinal hernias. Their findings demonstrated that the previously reported high incidence of symptomatic inguinal hernias that developed after open RRP can be explained by a failure to diagnose preexisting inguinal hernias and the development of new hernias. Fukuta *et al.* [41] identified subclinical IH in 20 (20.4%) of 98 patients who had undergone RRP on the preoperative CT images, with a great incidence (60.6%) IH within 12 months. The surgeons should attach importance to subclinical IH examined by CT scans.

6. Conclusion

The inguinal hernia is a common complication after RP. However, the risk factors and mechanism are not precisely explained till now. There is still no one efficient method to prevent the development of IH after RP. Some randomized clinical trials should be taken to explore this procedure. Further study of preventing the IH occurred is urgently needed.

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