Contralateral Patent Processus Vaginalis Repair in Boys: Healing or Killing the Possible

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Abstract

Objective: To check the contralateral patent processus vaginalis (CPPV) prevalence in life, and the significance for the treatment.

Data sources: We performed a retrospective review of all inguinal hernia (IH) cases who underwent repair in our hospital from 2014 to 2018.

Study design: We analyzed the occurrence and treatment regularity in boys. Checked and compared the history, initial sides of hernia, CPPV and prognoses in different age groups.

Data collection: We checked all IH cases repaired in our hospital, picked out the male cases, including boys and men, recurrent cases were not enrolled.

Principal findings: A total of 3243 cases were enrolled, 2489 (right-sided IH 1411 (56.69%) vs left-sided IH 975 (39.17%), bilateral IH 103 (4.14%)) in children, and 754 (right-sided IH 485 (64.32%) vs left-sided IH 236 (31.30%), bilateral IH 33 (4.38%)) in adults. 1124 CPPV were checked in children with unilateral inguinal hernia (2386), 12 in adults of 267 (p<0.0001). There were no significant differences in recurrence rate between the blocks in children (p>0.05).

Conclusions: The incidence of inguinal hernia in boys was significantly higher than men. The number of cases declines rapidly with age in boys. Processus vaginalis obliterates and involutes, last for a long period, routine exploration on contralateral may kill the possible of self-obliterating capability.

Introduction

What is known on this topic inguinal hernia needs to be repaired to prevent incarceration include children and adults. With the introduction and promotion of laparoscopic repair in children, a large number of CPPV were exposed and repaired. Whether the CPPV need to be fixed is debatable. What this study adds is we believe the CPPV should not be repaired routinely.

During laparoscopic hernia repair, CPPV is closed with the concept of simultaneous closure of an open processus vaginalis\(^1\). A number of studies showed the incidence of CPPV is 50%-70\(^2,3\), the incidence of IH and CPPV is age dependent\(^4,5\). In this study, we investigated the characteristics of CPPV lifetime.

The states of our work

Almost all incarcerated IH in children and adults would be reduced by gentle manual pressure first if the patients state permitted. Regular operation was not recommended for children younger than 6 months old, unless there was a strong demand from the parents. It's not because we can't do it, this strategy can reduce the risk of anesthesia, and some children may self-healing. The hospital is Regional Medical Center, comprehensive Grade 3A hospital. Pediatric Surgery and General Surgery are two separated

**Patients And Methods**

**Patients**

A retrospective study was carried out on all male-patients with IH to the hospital, between 2014 and 2018. Below 15 years old was children group, repaired in pediatric surgery ward

the rest was adult group, repaired in general surgery ward. Recurrence cases were excluded from this study. The medical history and condition of boys provided by their parents or guardian, adults were provided by themselves or their close relatives.

**Groups comparisons**

**Children Group and Adult Group**

The variables evaluated were sex, age at operation, history, initial side of hernia, development of contralateral hernia (Fig. 1).

**Younger Group and Elder Group of children**

Younger than 18 months and older than 60 months in children were selected and divided into younger group and elder group. The variables evaluated were sex, age at operation, history, initial side of hernia, development of contralateral hernia.

**Follow up**

All children were followed up lasted 2 years at least. Follow-up form included Telephone surveys, WeChat and out-patient referrals. After the IH repaired, we given instructions on how to monitor for hernia recurrence, if there were clinical manifestations like these, come back to out-patient as soon as possible.

**Statistical analysis**

Demographic data such as age, medical history, side of hernia, number of CPPV detected by laparoscopy, were collected. Continuous data were expressed as mean (s.d.) and analysed using two-sample t test. $\chi^2$ tests were used to determine significance of differences in the incidence of CPPV with regard to side. All tests were two-sided and $P<0.05$ was considered statistically significant.

**Results**

**Clinical data**
From 2014 to 2018, a total of 3,243 cases were recorded, mean age was 14.74±23.14 years, the minimum age was 4 months—the oldest age was 93 years old; mean medical history was 1.63±5.62 years, the longest was 70 years, was a 78-year-old man, appearance of the initial symptoms when he was 8 years old (51 cases onset-age less than 15 years old, ratio to 6.76%).

2489 cases in children group, mean age was 3.36±2.47 years, mean medical history was 0.74±2.71 years, right-sided IH 1409 (56.69%) cases, left-sided IH 975 (39.17%), bilateral IH 103 (4.14%) (Table 1). Statistics show, both onset age-case and repair age-case declined rapidly at younger ages ($R^2$=0.9715, 0.8806) (Fig.2).

754 cases in adult group, mean age was 53.65±17.40 years, mean medical history was 4.57±10.00 years (children VS adults, $t$=17.10, $p< 0.0001$), right-sided IH 487 (64.32%) cases, left-sided IH 236 (31.30%) (children VS adults, $\chi^2$=15.39, $P < 0.0001$), bilateral IH 33 (4.38%) ($\chi^2$=0.082, $P =0.7747$) (Table 1). The case ratio of children VS adults was 3:1, the age-range ratio of the groups was 1:5.

<table>
<thead>
<tr>
<th>Boys</th>
<th>Men</th>
<th>t / $\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total(T)</td>
<td>2489</td>
<td>754</td>
<td></td>
</tr>
<tr>
<td>Mean age(years)</td>
<td>14.73±23.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team mean age(years)</td>
<td>3.36±2.47</td>
<td>53.65±17.40</td>
<td></td>
</tr>
<tr>
<td>Min age(months)</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max age(years)</td>
<td>93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team median age(years)</td>
<td>2.5</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Median age(years)</td>
<td>8</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>Case ratio</td>
<td>3:1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age-range ratio</td>
<td>1:5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right(R)/%</td>
<td>1411</td>
<td>56.69</td>
<td>485</td>
</tr>
<tr>
<td>Left(L)/%</td>
<td>975</td>
<td>39.17</td>
<td>236</td>
</tr>
<tr>
<td>Bilateral(B)/%</td>
<td>103</td>
<td>4.14</td>
<td>33</td>
</tr>
<tr>
<td>History(years)</td>
<td>0.74</td>
<td>4.57</td>
<td>17.10</td>
</tr>
</tbody>
</table>

$\chi^2$ test, ##(R+L) VS B, $\chi^2$ test, ###Unpaired t test.

**Children vs Adults**
At laparoscopy, 1124 (47.11%) CPPV were checked in 2386 unilateral IH of children, just 12 (4.49%) CPPV in 267 unilateral IH of adults ($\chi^2=178.1$, $P<0.0001$). The CPPV on the right side was identified in 50.77% of the children with left unilateral IH, compared with 44.58% on the left in children with right inguinal hernia ($\chi^2=8.869$, $P=0.0029$). Just 5.26% in right-sided IH vs 4.19% in left-sided IH of adult ($\chi^2=0.1463$, $P = 0.7021$). The incidence of CPPV was significant difference between the same-sided of groups (Left IH: $\chi^2 =58.55$, $P<0.0001$; Right IH: $\chi^2 =114.6$, $P < 0.0001$) (Table 2).

Table 2 Clinical details of unilateral IH in boys and men included in the study.

<table>
<thead>
<tr>
<th></th>
<th>boys</th>
<th>men</th>
<th>$\chi^2$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>2386</td>
<td>267</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R/%</td>
<td>1411</td>
<td>59.14</td>
<td>191</td>
<td>71.54</td>
</tr>
<tr>
<td>L/%</td>
<td>975</td>
<td>40.86</td>
<td>76</td>
<td>28.46</td>
</tr>
<tr>
<td>CPPV/%</td>
<td>1124</td>
<td>47.11</td>
<td>12</td>
<td>4.49</td>
</tr>
<tr>
<td>CPPV-L/%</td>
<td>495</td>
<td>50.77</td>
<td>4</td>
<td>5.26</td>
</tr>
<tr>
<td>CPPV-R/%</td>
<td>629</td>
<td>44.58</td>
<td>8</td>
<td>4.19</td>
</tr>
</tbody>
</table>

CPPV-R: CPPV of right-sided IH; CPPV-R: CPPV of left-sided IH; #CPPV-R vs CPPV-L in boys, ## T (theoretical frequency)=3.42×5, Chi-square with Yates' correction, CPPV-R vs CPPV-L in adult.

Younger vs Elder of children

Two groups were generated: younger group including younger than 18 months with a total of 576 cases, right-sided IH 311 (53.99%) cases, left-sided IH 225 (39.06%), bilateral IH 40 (6.94%), mean age was 13.72±3.48 months, mean medical history was 4.92±4.54 months; elder group including children older than 60 months with a total of 538 cases, right-sided IH 275 (51.12%) cases, left-sided IH 253 (47.03%) (right-sided VS left-sided, $\chi^2=3.792$, $P=0.0515$), bilateral IH 10 (1.86%) ($\chi^2=16.78$, $P<0.0001$), mean age was 87.15±25.30 months, mean medical history was 16.10±25.71 months (t=10.26, $p< 0.0001$).

256 (47.76%) CPPV were checked in 536 unilateral IH of younger group, 225 (42.61%) CPPV in 528 unilateral IH of elder group ($\chi^2=2.845$, $P=0.0916$). The CPPV on the right side was identified in 48.89% of the younger group with left unilateral IH, compared with 46.95% on the left in children with right inguinal hernia ($\chi^2=0.1977$, $P= 0.6566$). 49.01% in left-sided IH vs 36.73% in right-sided IH of elder group ($\chi^2=8.132$, $P=0.0043$). The incidence of CPPV was significant difference on right-sided between the groups (Left IH: $\chi^2=0.0007206$, $P=0.9786$; Right IH: $\chi^2=6.249$, $P=0.0124$) (Table 3).
Table 3 Clinical details of younger and elder boys included in the study.

<table>
<thead>
<tr>
<th></th>
<th>Younger</th>
<th>Elder</th>
<th>t /χ²</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age range(months)</td>
<td>≤18[4-18]</td>
<td>≥60[60-180]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>576</td>
<td>538</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R/%</td>
<td>311</td>
<td>53.99</td>
<td>275</td>
<td>51.12</td>
</tr>
<tr>
<td>L/%</td>
<td>225</td>
<td>39.06</td>
<td>253</td>
<td>47.03</td>
</tr>
<tr>
<td>B/%</td>
<td>40</td>
<td>6.94</td>
<td>10</td>
<td>1.86</td>
</tr>
<tr>
<td>CPPV/%</td>
<td>256</td>
<td>47.76</td>
<td>225</td>
<td>42.61</td>
</tr>
<tr>
<td>CPPV-L/%</td>
<td>110</td>
<td>48.89</td>
<td>124</td>
<td>49.01</td>
</tr>
<tr>
<td>CPPV-R/%</td>
<td>146</td>
<td>46.95</td>
<td>101</td>
<td>36.73</td>
</tr>
</tbody>
</table>

|                  |         |           |       |       |
| History(months)  | 13.72   | 16.08     | 2.182### | 0.0293 |

#CPPV-R vs CPPV-L in younger, ##CPPV-R vs CPPV-L in elder, ### Unpaired t test.

Follow up

A total of 2329 (93.57%) children was followed up at least 2 years by the ways, recurrence rate of children was 0.73% (17 of 2329). Recurrence rate of contralateral clogged processus vaginalis (PV) at laparoscopy was 0.32% (4 of 1262), the rate of repair-sided was 0.35% (13 of 3716), the rate of IH-sided was 0.39% (10 of 2592), the rate of CPPV-sided was 0.35% (3 of 1124), there were no significant differences between the blocks (Fig.3).

Discussion

The development of inguinal hernia in boys is associated with the physiological process of testis during embryonic period⁶, the testis descends from its retroperitoneal occurs between 25 and 35 weeks of gestation, incomplete involution results in a patent processus vaginalis (PPV)⁷. The existence of PPV is highest during infancy and declines with age⁵, as high as 80% in term male infants, declines to 20-30% in adult⁸.

The younger-aged, the higher of the clinical incidence of PPV, the incidence of IH in premature infants can be as high as 30%⁹, 3%-5% in full-term infants⁵, 0.8%-4.4% in children less than 18 years of age¹⁰. Although our statistics was not started from newborns, both onset-case and repair-case showed an
aggregation at the young age, and the numbers of the both declined rapidly in earlier \((R^2 = 0.88\) and \(0.97)\), all the data implicate parts of the PPV obliterated with age.

The left testis descends before the testis on the right\(^{11}\), so the Involution of the left PV precedes that of right, consistent with the observation that 60\% of inguinal hernias occur on the right side\(^{5}\), but IH mostly present with bilateral IH in preterm infants\(^{9}\), the Involution of both-sided PV precedes with age, and left PV obliterates first normally. Our data shown the CPPV in left-sided IH more than right-sided IH.

Inguinal hernias in children are not caused by structural factors in the abdominal wall, because the PV did not close or atresia occurred during the growth process, isolated high ligation of the hernia sac can cure inguinal hernias in children\(^{12}\). Over the past decade, laparoscopic techniques have been applied widely in the management of common pediatric diseases\(^{13}\). Laparoscopic repair in children is considered safe, effective and more convenient technique\(^{14,15}\), what's more CPPV can be discovered and repaired to prevent the formation of metachronous inguinal hernia (MIH)\(^{16}\). A number of studies showed the incidence of CPPV is 50\%-70\%\(^{2,3}\), but the benefit from the repair was tiny, maybe just \(1/10\)^{17}, \(1/18\)^{18}, \(1/21\)^{19}. However, there was no evidence that repair in CPPV can reduces the postoperative recurrence rate\(^{20,21}\). And explore data showed there was no statistic difference between LP and OP\(^{22}\). And observation has a lower risk of morbidity compared with contralateral exploration\(^{23}\). But by laparoscopic, a nilateral inguinal hernia child had 50\% to repair the other side, and the preventive surgery does not revent or reduce the recurrence incidence\(^{22}\), the recurrence incidence of repaired CPPV is similar to contralateral clogged PV and IH-sided. The repairs do not decrease or increase the risk of inguinal hernia development in adulthood\(^{24}\). What's more, the general consensus states that prevention of incarceration of inguinal hernia per se is not a proper indication to perform surgery\(^{25}\), almost all incarcerated inguinal hernias can be reduced by gentle manual in children\(^{26}\). Although the repair technique is convenient, it may bring some serious complications to patients, such as such as spermatic cord injury, testicular atrophy, chronic pain and infertility in adulthood\(^{5,24,27-31}\), and with a 10-fold increase for recurrent repaired\(^{32}\). So we consistent with the authors’ previous study, There was no indication for contralateral routine exploration\(^{24,28,33-36}\).

In addition to described above, 15–37\% of PPV with no clinically apparent hernia in autopsy studies in adults, and 12\% (our data was 4.49\%) during the laparoscopic operation\(^{15}\). Compare with children, the incidence of PPV is lower. In consequence, CPPV could be asymptomatic presence majority,obliterated with age partly, the incidence of developed to hernias similar to the incidence of hernia recurrence, so we hold the opinion that LP in CPPV results in overtreatment.

**Conclusions**

Inguinal hernias in children are caused by the PV did not obliterates and involutes, PV is formed in the embryo and closed with age-growth, but not terminated after birth. CPPV may develop metachronous inguinal hernia (MIH), asymptomatic presence, or closed with age-growth. In the long term, most closed
before adulthood, a few are asymptomatic, less develop to MIH eventually. So laparoscopic inguinal hernia repair in children results in overtreatment.

**Declarations**

**Competing interests**

All authors declare that they have no competing interests.

**Medical ethics statement**

All cases covered in the submission were signed the informed consent by the patients and/or their legal relatives. The signed medical records were kept in the medical records room of Linyi Central Hospital. The Clinical diagnosis and treatment were in line with the World Medical Association Declaration of Helsinki and the Council for International Organizations of Medical Sciences International Code of Biomedical Ethics Involving Human Beings.

**References**


Figures

Figure 1

The incidence of CPPV in different groups.
Younger: aged ≤ 18 months, Elder: aged ≥ 60 months, c-lat: contralateral.

Figure 2

Children onset - treatment age trend chart.

Within a few years of birth, both onset age-case and treated age-case declined rapidly.
Figure 3

Recurrence rate of the blocks in the study.