Hypothesis: The combination of cesarean section with inguinal or umbilical hernia repair is safe, effective, and well-accepted compared with cesarean section alone.

Design: Retrospective comparative study.

Setting: Tertiary care university hospital.

Patients: Eight patients undergoing cesarean section combined with hernia repair (inguinal in 5 and umbilical in 3) vs 305 low-risk patients undergoing cesarean section alone.

Main Outcome Measures: Operation time, blood loss, opiate use, peripartum complications, hospital stay, hernia recurrence, and patient impression.

Results: The combined procedure took significantly longer than cesarean section alone in the case of inguinal but not umbilical hernia. There were no major complications. Wound healing was delayed, without infection, in 1 patient with an inguinal hernia. Blood loss, opiate use, and hospital stay did not differ significantly from those of controls. No hernia recurred after a mean observation period of 56 months. Seven of the 8 patients reported that they would recommend the combined operation.

Conclusions: Combined cesarean section and hernia repair avoids rehospitalization for separate hernia repair. With a single incision (in the case of inguinal hernia repair), single anesthesia, and single hospital stay, the combined procedure confers valuable advantages for both patient and hospital in time, cost, and convenience, not to mention avoiding the separation of mother from newborn entailed by reoperation. Our results in a pilot group indicate that the combination approach is safe, effective, and well accepted. Confirmation in a larger population should establish it as a recommendable procedure.
one sodium, 1 g intravenously) were used in all patients. Nurses checked the wound daily during hospitalization, and a physician checked the scar on discharge. The wound infection criteria were extensive cellulitis, discharge, or purulence.

All patients underwent routine early-outcome follow-up of hernia repair and cesarean section 6 weeks post partum. Long-term follow-up by physical examination was impractical, as 5 patients had moved or lived far away. It was therefore performed by structured telephone questionnaire at least 1 year post partum (mean, 56 months; range, 13-127 months), comprising questions as to pain at the hernia repair site, residual altered sensation, evidence of recurrence (surgical opinion or reoperation), and patient impression (whether they would recommend the combined procedure, and why).

Outcome in the 8 patients who underwent the combined procedure was compared with that in 305 low-risk women in our department who underwent elective cesarean section alone.9 Results are presented as mean±SD. The Mann-Whitney test was used to calculate significance (P<.05).

### RESULTS

Five women underwent inguinal hernia repair (unilateral in 4 and bilateral in 1) and 3 underwent umbilical hernia repair combined with cesarean section. In all cases but 1, the hernia was confirmed at operation; in case 4, inguinal exploration showed numerous large varicosities but no hernia sac, and the opened transversalis fascia was closed with a Shouldice repair. The prevalence of inguinal hernia in pregnancy in our hospital was about 1:2000. Six (75%) of the 8 women who developed a hernia in pregnancy were multiparas.

Operation time was significantly longer in the combined procedure group for inguinal but not umbilical hernia repair vs cesarean section alone (P<.001 and P=.27, respectively) (Table 2). The decrease in hemoglobin level was similar for the combined procedure (0.9±0.8 g/dL) and cesarean section alone (1.0±1.2 g/dL; P=.96). Opiate use did not differ significantly between the two groups (nicomorphine, 0.5±0.3 vs 0.4±0.2 mg/kg of body weight, respectively; P=.20). Cesarean section suture healing was delayed, without infection, along a 3-cm length in 1 patient with an inguinal hernia. Two patients had asymptomatic bacteriuria treated with antibiotics according to local policy. Hospital stay was similar in both groups (P=.46). At follow-up there was no complaint of pain or altered sensation at the hernia repair site, and no evidence of recurrence. One patient complained of pain on external rotation of the leg 6 years after operation and attributed this to the combined procedure. The other 7 patients expressed subjective satisfaction and recommended the combined procedure, primarily because it saved time and obviated the need for child care during reoperation.

### COMMENT

Our analysis of the potential benefit of combining cesarean section with hernia repair found no increase in complications, notably infection, over cesarean section alone. Furthermore, 7 of the 8 patients continued to endorse the acceptability of the combined procedure a mean of

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**Table 1. Characteristics of Patients Undergoing Combined Procedure**

<table>
<thead>
<tr>
<th>Patient No./Age, y</th>
<th>Para/Gravida</th>
<th>Hernia Type</th>
<th>Hernia Diagnosis, wk</th>
<th>Indication for Hernia Repair</th>
<th>Cesarean Section Repair</th>
<th>Anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/34</td>
<td>3/3</td>
<td>I</td>
<td>36</td>
<td>Cephalopelvic disproportion</td>
<td>Stoppa</td>
<td>Epidural</td>
</tr>
<tr>
<td>2/39</td>
<td>5/5</td>
<td>I</td>
<td>16</td>
<td>Breech</td>
<td>Stoppa</td>
<td>Intubation*</td>
</tr>
<tr>
<td>3/22</td>
<td>1/1</td>
<td>I</td>
<td>17</td>
<td>HIV</td>
<td>Stoppa</td>
<td>Spinal</td>
</tr>
<tr>
<td>4/27</td>
<td>2/2</td>
<td>I</td>
<td>28</td>
<td>Previous cesarean section</td>
<td>Shouldice</td>
<td>Spinal</td>
</tr>
<tr>
<td>5/28</td>
<td>2/5</td>
<td>(Bilateral)</td>
<td>30</td>
<td>Cephalopelvic disproportion</td>
<td>Bilateral shouldice</td>
<td>Epidual</td>
</tr>
<tr>
<td>6/29</td>
<td>2/2</td>
<td>U</td>
<td>20</td>
<td>U hermia</td>
<td>U hernia repair</td>
<td>Spinal</td>
</tr>
<tr>
<td>7/26</td>
<td>1/1</td>
<td>U</td>
<td>28</td>
<td>Arteriovenous angioma</td>
<td>U hernia repair</td>
<td>Spinal</td>
</tr>
<tr>
<td>8/37</td>
<td>2/3</td>
<td>U</td>
<td>31</td>
<td>Twins</td>
<td>U hernia repair</td>
<td>Spinal</td>
</tr>
</tbody>
</table>

Abbreviations: HIV, human immunodeficiency virus; I, inguinal (unilateral except where stated); U, umbilical.*Failed spinal anesthesia.

**Table 2. Individual and Cumulative Combined Procedure Outcome**

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Operation Time, min</th>
<th>Nicomorphine Use, mg/kg of Body Weight</th>
<th>Complications</th>
<th>Hospital Stay, d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>85</td>
<td>0.4</td>
<td>None</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>85</td>
<td>0.4</td>
<td>None</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>0.6</td>
<td>None</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>0.2</td>
<td>Delayed wound healing without infection</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>130 (Bilateral)</td>
<td>0.5</td>
<td>None</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>0.7</td>
<td>Asymptomatic bacteriuria</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>35</td>
<td>0.1</td>
<td>None</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>38</td>
<td>1.1</td>
<td>Asymptomatic bacteriuria</td>
<td>8</td>
</tr>
<tr>
<td>1-4</td>
<td>80 ± 7</td>
<td>0.5 ± 0.3</td>
<td>NA</td>
<td>6.4 ± 1.9</td>
</tr>
<tr>
<td>6-8</td>
<td>41 ± 8</td>
<td>0.4 ± 0.2</td>
<td>NA</td>
<td>6.9 ± 2.6</td>
</tr>
</tbody>
</table>

Abbreviation: CS, cesarean section alone (n = 305); NA, not applicable.

*Mean ± SD.
56 months later. The practical benefits are obvious: a 2-in-1 operation, with a single incision in the case of inguinal hernia repair, single anesthesia, and single hospital stay, conferring valuable advantages for both patient and hospital in time, cost, and convenience, not to mention avoiding the separation of mother from newborn entailed by reoperation.

Proponents of postpartum hernia repair may argue that the combined procedure increases the complication rate, because of blood loss and wound infection resulting from the longer operation time, and prolongs hospitalization. Our data confound this view. Hernia repair prolonged the average duration of cesarean section, but the time remained within the normal range reported for hernia repair in the literature.10-12 In all patients undergoing umbilical or unilateral inguinal hernia repair, operation times remained below the 90-minute threshold associated with an increase in wound infection rates; 61 to 90 minutes (4.0% infection rate), as opposed to 91 to 120 minutes (6.2%) or greater than 120 minutes (8.0%).13 Wound healing was delayed, without infection, in only 1 patient. Hospitalization was not prolonged in patients undergoing the combined procedure. Our results confirmed those of Gonzalez-Ojeda et al,1 who combined inguinal hernia repair with transurethral prostatectomy.

One limitation of the study is its retrospective nature, but randomization for cesarean section with or without hernia repair is hardly feasible given the low prevalence. A related limitation is our sample size. Eight cases may appear few, but to our knowledge there is no equivalent series in the literature. In these 8 cases, our complications and recurrence rates were zero. Large differences in hernia recurrence rates have been reported: between 0.2%14 and 33%,15 depending on surgical technique, length of follow-up, and method of recurrence assessment.12,16,17 Rates also increase with time,18 with most recurrences occurring early, in the first 3 months after mesh repair.19 A final limitation is that, although structured telephone interview is an established substitute for physical examination, a recent study of laparoscopic inguinal hernia repair found that 2 of 3 recurrences were totally asymptomatic and only diagnosed on clinical examination.17

Whether it is best to repair a pregnancy hernia during the pregnancy itself, at cesarean section, or postpartum, after involution of the uterus, remains a matter of dispute. Barber and Graber20 recommended repair during pregnancy only in the case of strangulation and incarceration. Irreducible umbilical hernias were also to be repaired before the enlarging uterus caused possible strangulation. Otherwise, if there were no complications during pregnancy, repair was to be deferred until as soon as possible postpartum. One reason for deferral is that anesthesia and surgery during pregnancy could precipitate uterine irritability and induce premature labor, up to 1 week postoperatively.20 Other proposed reasons have been the extreme vascularization of the uterus, and the induction of collagen remodeling by relaxin during pregnancy,22 with the softened tissue predisposing to hernia recurrence.23

Cesarean section combined with inguinal or umbilical hernia repair avoids rehospitalization and appears safe, effective, and well accepted. It neither increased the complication rate nor prolonged the hospital stay, and, in our pilot sample, it was associated with no long-term recurrence. Confirmation of these results in a larger study would establish combined cesarean section and hernia repair as a recommendable procedure.

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REFERENCES