When an operable disease process exists in the uterus, fallopian tubes, or ovaries, the incision of choice in the majority of cases is the transverse lower abdominal incision, including the Pfannenstiel and Maylard incisions. These transverse incisions virtually eliminate postoperative incisional herniation, and scar formation is minimal since the incision is parallel to Langer's lines. Patients appreciate that the scar is very fine and out of view. The postoperative course tends to be more comfortable, and morbidity is less than that observed with the midline vertical incisions.

Abdominal gynecologic operations are performed by way of three basic incisions: the low midline vertical incision; the suprapubic transverse incisions, which include the Pfannenstiel, Maylard (Bardenheuer), and Cherney incisions; and the supra- and infraumbilical incisions.

In 1823 the French obstetrician Baudelocque described the transverse incision in the lower abdomen for use in cesarean sections. In 1900, Pfannenstiel popularized the suprasymphysisal fascial transverse incision, which he advanced for all pelvic surgery. Pfannenstiel originally described 51 cases in which he employed the transverse incision in the lower abdomen for treatment of pelvic pathology. By definition, the Pfannenstiel incision is a curved incision with the convexity directed downward. The skin, superficial fascia, and aponeurosis are incised transversely. The transversalis fascia and peritoneum are opened vertically.

In 1907, Maylard advocated the transverse incision for all abdominal surgery. The Maylard technique, also known as the Bardenheuer incision, involves the transverse incision of all layers of the abdominal wall, including the rectus muscles. A modification of the Maylard incision was described by Cherney in 1941. Cherney's incision is a transverse incision in the lower abdomen whereby the tendons of the rectus muscles are cut at their insertion in the posterior surface of the pubic symphysis. In closing the incision, it is not necessary to suture the recti tendons to the symphysis. Closure is achieved by reapproximation of the rectus sheath.

The location and type of abdominal incision which the gynecologic surgeon will make is dependent on several factors. The incision should provide adequate operative exposure while showing respect for the anatomy of the abdominal wall and taking into consideration any previous pelvic surgery or pathology that is present. It should allow not only for simplicity and speed of procedure when needed, but also for good wound healing and postoperative comfort for the patient. Cosmetically, the incision should be acceptable to the patient. The majority of these requirements are fulfilled best by the transverse lower abdominal incisions. A review of the anatomy and physiology of the lower abdominal wall further emphasizes the greater adaptability of transverse incisions to gynecologic operations.

**Anatomy and physiology of the abdominal wall**

The pertinent facts concerning the functional anatomy and physiology of the lower abdominal wall are summarized below.

**Langer's lines**

It is well known that a finer scar can be achieved by an incision that is parallel to Langer's lines of elasticity than by one that is placed obliquely. Conway has demonstrated that the lines of elasticity of the skin in the suprapubic region run transversely rather than obliquely vertical as originally described by Langer. Therefore, a transverse incision follows the lines of...
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elasticiy in the lower abdomen.

Blood supply
A rich blood supply affords the opportunity for better wound healing. The lower abdominal wall is supplied by the inferior epigastric and superficial epigastric arteries. These vessels anastomose freely with the superior epigastric vessels. The poorest blood supply is to the linea alba. Since the linea alba is relatively avascular, it is slower to heal and is predisposed to postoperative incisional hernia. The vertical incision is carried through the linea alba, whereas a transverse incision violates only a small part of it.

Muscles and aponeuroses
The fibers of the anterior rectus sheath and transversalis fascia have a transverse direction. Thus, an incision made in the plane of these fibers tends to be stronger than one that incises the fibers at right angles.

The transverse incision also is strengthened by contractions of the oblique abdominal muscles (external abdominal oblique, internal abdominal oblique, and the transverse muscles of the abdomen). A vertical incision tends to be disrupted by contractions of these muscles. Contraction of the rectus abdominus tends to strengthen both types of incisions.

Rectus muscle physiology
This vertical muscle of the abdominal wall is divided into segments by three transverse tendinous inscriptions. Each segment tends to act separately, and when the muscle is cut transversely the fibers retract minimally, based on this independent segmental action. When a Maylard incision is used, an additional tendinous inscription forms at the incisional site in the rectus muscle.

By reviewing these anatomic facts, it can be seen that a transverse abdominal incision, for example, the Maylard or Pfannenstiel incision, is more anatomically correct than a vertical incision.

Alleged disadvantages of transverse incisions
Surgeons who favor low midline vertical incisions for gynecologic surgery do so mainly as a matter of habit based on their training experience. Many authors speak against transverse abdominal incisions on the basis that this technique is more time-consuming. They state that a vertical incision is much simpler to perform, especially when they are operating for acute hemorrhage. But Gaal reports that "the average abdomen can be opened comfortably, using Pfannenstiel's incision, in 45 seconds."

In addition to this alleged disadvantage, often it is pointed out that vertical incisions provide the best exposure. Finally, it is stated that a transverse incision encounters more bleeding and thus a greater chance of hematoma formation.

Each of these points is discussed in the following sections.

Advantages of transverse abdominal incisions
Fewer incisional hernias
The transverse abdominal incision virtually eliminates postoperative incisional hernias. Hunter reported no incisional hernias in 700 consecutive transverse incisions. In his series the Pfannenstiel incision was used in 673 cases (96.1 percent); Maylard's incision was used in the remaining 27 cases (3.9 percent).

Gaal reports that the Pfannenstiel incision was employed in a series of 1,287 patients seen in an Obstetrical and Gynaecological Unit from 1954 to 1962. Only one incident (0.08 percent) of incisional ventral herniation occurred in his series.

A review of 282 women seen at the Mayo Clinic from 1956 to 1960 with postoperative incisional hernias was reported by Souders and Pratt. Of the 282 cases, 104 of the hernias followed gynecologic abdominal surgery. The type of incision was determined in all but 19 cases. In 75 cases, the original
operation was made via a low midline incision; in four cases, a low left rectus incision was used, and in three, a low right rectus incision. A suprapubic transverse incision was done in two cases.

Finally, Biswas\textsuperscript{9} reports on 340 patients who had abdominal operations between 1966 and 1968. One hundred and forty-three (42 percent) of the operations employed the Pfannenstiel incision and 197 (58 percent) were done using vertical incisions. Table 1 shows the results.

**Increased postoperative comfort of the patient**

Patients have less distress from coughing and deep breathing during the postoperative period when a transverse incision is used. They are able to move about in bed with greater freedom because contractions of the abdominal muscles do not pull the incision apart. This is because the incision is made in the direction of the fibers of the aponeuroses of the muscles.

Vital capacity is reduced less with the transverse incision as opposed to the midline vertical incision because there is less tendency for deep breathing to aggravate the lower abdominal incision. This parameter of pulmonary function has been studied and reported by Elliott.\textsuperscript{10}

**Better exposure of uterus, tubes, and ovaries**

Cherney\textsuperscript{4} states that “the transverse diameter of the lower abdomen is approximately 25 percent longer than the distance from the umbilicus to the symphysis pubis in the male and even longer in the female.” Thus, there is greater exposure with the transverse incision. Even greater exposure is afforded with the Maylard incision because less tissue distortion and retraction are required.

Also, the pelvic organs are situated directly beneath the center of the transverse incision, whereas in a vertical incision the lower extent of the incision overlies the pelvic organs.

Upper abdominal exploration may be performed adequately through either the Pfannenstiel or Maylard incision.

**Superior cosmetic effect**

The transverse incision is made in the direction of Langer’s lines in the skin creases in the lower abdomen. The resultant scar is much finer than the scar seen in vertical incisions. In addition, the incision is often out of view. Patients appreciate both of these factors.

**Lower morbidity**

Because the transverse incision is more anatomic and physiologic, postoperative morbidity is less than with the vertical incision. Biswas\textsuperscript{9} reports almost complete absence of evisceration, herniation, wound infection, and pulmonary embolism in 143 cases in which the Pfannenstiel incision was employed (Table 1). These 143 cases included cesarean sections and 50 abdominal hysterectomies. The incidence of wound infection in vertical incisions was 10 times greater than in Pfannensteil’s incision.

**Contraindications**

In cases in which other major operative procedures are to be performed in addition to pelvic surgery, a vertical incision would be recommended. This would enable the surgeon to extend the incision in order to gain access to the other abdominal viscera.

Most surgeons agree that a transverse incision is not suitable for removal of pelvic tumors larger than

<table>
<thead>
<tr>
<th>Complications</th>
<th>197 vertical</th>
<th>143 Pfannenstiel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative evisceration</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Incisional hernia</td>
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<td>0</td>
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<td>Resuturing of wound</td>
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<td>1</td>
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<td>Infection with or without</td>
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<tr>
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<td>2</td>
</tr>
<tr>
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<td>25</td>
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<tr>
<td>Pulmonary embolism</td>
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</tr>
</tbody>
</table>

*Table 1. Complications following abdominal surgery using Pfannenstiel's incision compared with the vertical incision (Table adapted from Biswas\textsuperscript{9}).*
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that corresponding to a 24-week gestation. A tumor of this size is handled best via a midline vertical incision. Cesarean sections may be performed with good exposure using either a Pfannenstiel or Maylard incision.

Some authors recommend that midline vertical incisions be employed for emergency operations such as ruptured ectopic pregnancy, because the incision is less time-consuming than a transverse incision. As mentioned, Gaal\textsuperscript{6} has disputed this argument, stating that the average abdomen can be opened comfortably in 45 seconds with a transverse incision.

Finally, increased bleeding with the transverse incision often is mentioned in argument against its use. The vast majority of surgeons state that there is greater chance for bleeding with the transverse incision, but no problems develop if the branches of the inferior and superior epigastric vessels are securely ligated. The vascularity of the abdominal area is responsible in part for the more rapid and more secure healing associated with Pfannenstiel and Maylard incisions.

Summary

Suprapubic transverse abdominal incisions of Pfannenstiel or Maylard are the preferred incisions for operative disease of the uterus, fallopian tubes, and ovaries. When the history and physical examination suggest that disease is limited to these pelvic organs, a lower abdominal transverse incision will offer the following advantages over a midline vertical incision: reduced incidence of postoperative incisional hernia; minimal scar formation that is out of view; increased postoperative comfort to the patient; lower morbidity; and better operative exposure.

The Maylard incision compared to the Pfannenstiel incision provides even more operative exposure, with less retraction required. Maylard's incision also is more economic in that less packing is required to keep the intestinal contents away from the operative field.

Transverse incisions are not adequate if operative procedures are to be performed on abdominal viscera other than the pelvic organs. Large pelvic masses are handled most satisfactorily via a midline vertical incision.

If these restrictions are observed, the transverse lower abdominal incision proves to be the most satisfactory incision for the majority of abdominal gynecologic surgery.


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