

THE CONTROL OF MORBIDITY AND MORTALITY FOLLOWING PELVIC SURGERY¹

A REVIEW OF A SECOND SERIES OF ONE THOUSAND CONSECUTIVE PERSONAL CASES

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SIR D'ARCY POWER has aptly said: "There are three stages in the career of a surgeon. In the first he loses the fear of hemorrhage; in the second he ceases to multiply operations; in the third he acquires the moral courage to stop in the middle of an operation when he finds the condition inoperable. There is a final stage which he never attains with the present span of life, the ability to gauge correctly the vital resistance of the patient; yet on this depends the success of every operation."

In a previous communication² I made a critical analysis of 1000 consecutive personal operative cases immediately preceding January 1, 1930, with the following summary and conclusions:

In a series of 1000 consecutive gynecological operative cases, there were complications during convalescence in 79, a morbidity of 7.9 per cent; 19 patients died, a mortality of 1.9 per cent.

Postoperative transfusion should never be necessary except in the presence of ectopic pregnancy, secondary hemorrhage, or sepsis.

Pre-operative cystoscopy and renal function tests will eliminate many useless pelvic operations.

Severe anemia, pyorrhea, respiratory affections, a compromised myocardium, arterial hypertension, and impaired metabolism, are indications for postponing operation in elective cases; spinal anesthesia may reduce the hazards of emergency cases.

Radiation and diathermy are dangerous in the presence of active infection or necrobiosis.

Meticulous peritonealization and burying all suture knots minimizes the likelihood of postoperative intestinal obstruction.

The incidence of pulmonary complications can be lessened by the invariable employment of a skilled anesthetist.

Correcting indicanuria and obstinate constipation before operation will practically eliminate postoperative pyelitis.

Persuading the patient to practice active motion of the extremities throughout convalescence is good insurance against thrombophlebitis and embolism.

Pronounced tachycardia developing during the first half hour of anesthesia is an indication to terminate the operation as soon as possible.

²Dannreuther, Walter T. The control of morbidity and mortality following pelvic surgery. *Surg., Gynec. & Obst.*, 1930, 51: 522.

¹From the Department of Gynecology, New York Post-Graduate Medical School and Hospital, Columbia University. Read before the Central Association of Obstetricians and Gynecologists, Omaha, Nebraska, October 10-12, 1935.

Unpreventable surgical shock will develop occasionally in profoundly septic patients.

Patients with a high metabolic rate should not be subjected to radiation.

Since the publication of the prior series of cases (designated hereafter as Series A), another group of 1000 (identified as Series B), has been completed and I now presume to compare the end-results with the purpose of indicating how each operator may reduce post-operative morbidity and mortality by scrutinizing the details of successive groups of his own cases. Both groups serving as the basis for this presentation include patients admitted to my ward service at the New York Post-Graduate Hospital, as well as private patients. No patient was denied surgical relief solely because of an unfavorable prognosis. I am convinced that personal cases only should be utilized for evaluating the caliber of the pre-operative study and preparation of the patients, and to ascertain whether or not the morbidity was as low as it should have been, and whether or not any of the fatalities could have been avoided. It is far more profitable to criticize ourselves than others.

Individualities can never be standardized and there are bound to be factors involved in the treatment of patients by different members of the same hospital staff. Personal experiences are much more enlightening than the array of a large mass of statistical data taken from the records indiscriminately. We can teach others operative technique, but we cannot endow them with dexterity; we can inculcate surgical judgment, but we cannot assure its exercise; and we can outline the principles of postoperative treatment, but the responsibility for their application must always devolve upon the one in actual attendance upon the patient. Hence, I believe that it is unfair to appropriate another's successes or include his failures in the assay of a series of end-results.

Since most gynecological operations are elective rather than emergent, there is usually ample opportunity for thorough pre-operative preparation of the patients. The assurance of metabolic activity, fortified vital resistance, and mental placidity in each one when she reaches the operating table is an objective just as important as dexterous surgical technique. On the other hand, over-enthusiastic pre-operative measures, such as starvation, dynamiting the intestinal tract with drastic purgatives, and a justifiable apprehension on the part of the patient undoubtedly contributed materially to the discouraging morbidity and mortality in the statistics of the pioneers in pelvic surgery. Toleration of anesthetic agents and operative trauma decreases in direct proportion to impairment of physiological processes. The test of good judgment is not the survival of the patient, but an uneventful convalescence.

TABLE I.—MORBIDITY AND MORTALITY

	Series A	Series B
Consecutive gynecological cases.....	1000	1000
Postoperative complications.....	79	53
Morbidity per cent.....	7.9	5.3
Deaths.....	19	8
Mortality per cent.....	1.9	0.8

Comparing the two groups, it is apparent that I succeeded in effecting a 34 per cent reduction in morbidity and a 57 per cent reduction in mortality. Of course, a few patients in both series had multiple complications, so that the incidence of complications is slightly higher than the morbidity percentage.

TABLE II.—POSTOPERATIVE COMPLICATIONS

	Series A	Series B
Gastro-intestinal.....	20	6
Pulmonary.....	17	10
Wound.....	16	12
Urinary.....	12	9
Cardiovascular.....	11	9
Systemic.....	7	4
Postoperative hemorrhage.....	3	4
Miscellaneous.....	0	7
Total.....	86	61

Table II shows a decided diminution in all of the important complications except postoperative hemorrhage. The seven miscellaneous conditions encountered only in series B were all of trivial importance, none of them jeopardizing life.

TABLE III.—GASTRO-INTESTINAL COMPLICATIONS

	Series A	Series B
Fecal fistula.....	6	0
Acute peritonitis.....	5	4
Acute intestinal obstruction.....	3	0
Pseudo-ileus.....	2	0
Paralytic ileus.....	1	1
Duodenal fistula.....	1	0
Acute dilatation of stomach.....	1	1
Acute parotitis.....	1	0
Total.....	20	6

It is a source of satisfaction to record the avoidance of all postoperative fistulas and organic intestinal obstructions. This may be fairly ascribed to the utmost gentleness in separating bowel adhesions, recognition of endometriosis of the rectovaginal septum during operation, refusal to irradiate any patient suspected of harboring a latent pelvic infection, and careful peritonealization of all raw surfaces. In those instances in which a denuded surface oozed slightly or could not be satisfactorily covered otherwise, I have used sheets of gutta-percha tissue to prevent visceral agglutination, bringing the ends out through the lower angle of the abdominal wound.

Acute peritonitis supervened once within 24 hours after a radium application to a freely movable cervical stump for carcinoma; in another patient after a laparotomy for extensive papillary cystadenocarcinoma of the ovary in an elderly debilitated woman; in another case soon after a laparotomy for ruptured pyosalpinx; and in a fourth patient after a celiotomy for retroversion, extensive pelvic adhesions, chronic appendicitis, and a dilated cecum. The three latter patients died.

The single instance of ileus was an incidental autopsy finding in the septic patient who had the ruptured pyosalpinx before operation and who really died of septicemia.

Acute dilatation of the stomach is no longer a postoperative sequel of consequence, since the Levine tube is now almost universally employed early to relieve gastric distress.

Red, spongy gums, or other evidence of pyorrhea, are deemed indications for post-operative operation in all elective cases. Acute parotitis, always distressing, and often fatal, occurs not when mouth and teeth are clean.

In series A, 8 gastro-intestinal complications were regarded as preventable. In series B, all 6 were apparently inevitable.

TABLE IV.—PULMONARY COMPLICATIONS

	Series A	Series B
Pneumonia.....	12	1
Acute pulmonary edema.....	2	0
Pleurisy.....	1	1
Empyema.....	1	0
Pulmonary infarcts.....	1	2
Atelectasis.....	0	1
Bronchitis.....	0	5
Total.....	17	10

Although the difference in the incidence of pulmonary complications is gratifying, the most significant decrease is in the number of pneumonias. In series A, there were 7 bronchial, 3 lobar, 1 influenza, and 1 hypostatic. While this series of cases was accumulating, my ward patients were furnished anesthesia by comparatively inexperienced anesthetists. In commenting in the previous paper on the fact that 11 of the 17 complications were noted in ward patients, I stated that "it seems fair to infer that the training of a larger number of anesthetists involves the risk of an increased number of pulmonary complications." The New York Post-Graduate Hospital soon thereafter abolished its course in anesthesia and practically all of the patients in series B were attended by skilled anesthetists. However, I believe that another precautionary measure probably should be credited with the reduction in pulmonary complications in general, and the pneumonias in particular. Coincidentally with the start of series B, I requested my anesthetists routinely to rebreathe every patient with 10 per cent carbon dioxide in oxygen just before the completion of the operation, irrespective of the anesthetic agent employed. And in every case in which a patient manifested an excess of bronchial mucus or a tendency to cough, my resident carried out the same procedure two or three times daily until the danger signals disappeared. The stimulation of the respiratory center as expressed by the prompt increase in respiratory rate, the depth of inspiration, and the pink tinging of the skin, as a result of the pulmonary hyperventilation, is so striking that I am convinced of its value, despite the

pessimism of several experimental observers. It seems logical to suspect that the 5 cases of bronchitis would have eventuated in bronchopneumonia without the protection of the carbon dioxide-oxygen administration.

A succession of pulmonary infarcts, diagnosed by an internist, prolonged the convalescence in 2 cases, once after a vaginal plastic operation, and once after a hysterectomy for fibroids under spinal anesthesia.

The single instance of atelectasis was a terminal massive collapse of the lungs discovered at autopsy in a patient dying of purulent peritonitis.

There were no pulmonary complications in series B that can be regarded as having been preventable, and none that caused death.

TABLE V.—WOUND COMPLICATIONS

	Series A	Series B
Infected abdominal wounds.....	13	4
Dehiscence of abdominal wound.....	0	3
Hernia in abdominal wound.....	0	1
Hematoma of abdominal wound.....	0	1
Abdominal wound sinus.....	0	1
Infected perineal wounds.....	3	1
Hematoma of vulva.....	0	1
Total.....	16	12

Whereas the number of infections in primarily clean wounds is extremely low, the occurrence of disruption of the abdominal wound in 3 cases is not pleasant to contemplate. One of these patients was markedly asthenic and developed a bronchitis with a racking cough 24 hours after a hysterectomy for fibroid. On the sixth day she complained of pain in the region of the wound, with the issuance of a little blood tinged exudate between the sutures, and began to vomit. Although the skin margins had apparently united, when the stitches were cut, two loops of gut were found insinuated between the peritoneal and fascial edges. Another patient manifested the same symptoms on the eighth day, with a similar wound rupture. The third patient was operated on under spinal anesthesia for multiple pathological conditions, and developed a dehiscence on the sixth day. All three wounds were reopened under local anesthesia and resutured with through and through silkworm gut sutures after the eviscerated loops were replaced. The wounds

healed firmly thereafter. In none of the wounds was there any trace of the catgut used for closure of the peritoneum and fascia. There must have been rapid proteolytic digestion of the catgut before fibroplastic production was sufficient to splint the wounds. The first two patients recovered; the third died on the eighteenth postoperative day from peritonitis, pulmonary atelectasis, and fatty liver infiltration.

One patient presented a small hernia in the abdominal wound before her discharge from the hospital, probably caused by forcible vomiting early in her convalescence.

A small abdominal sinus persisted for a year after a fixation of the vagina to the abdominal wall, with reefing of the broad and round ligaments, for a post-hysterectomy prolapse. It closed after discharging a linen suture.

Approximation of the vaginal fibers of the levator ani muscles with kangaroo tendon and a subcuticular closure of the skin margins evidently minimize perineal wound infections, only one occurring in 218 perineorrhaphies in series B. One hematoma of the vulva appeared 24 hours after the extirpation of a Bartholin cyst, probably because a small vessel that should have been ligated was overlooked.

The number of wound complications that might have been prevented is problematical.

TABLE VI.—URINARY COMPLICATIONS

	Series A	Series B
Acute cystitis.....	3	4
Acute pyelitis.....	8	3
Suprapubic urinary fistula.....	1	0
Vesicovaginal fistula.....	0	1
Transitory hematuria.....	0	1
Total.....	12	9

Omitting cases of postoperative simple bladder irritation without acute inflammatory changes in the vesical wall, the incidence of cystitis was low in both series. This may be credited to routine catheterization every 6 hours for 3 days, irrespective of the inclination to void, in hysterectomy cases and all others in which the bladder was subjected to trauma during operation. Keeping the bladder free from overdistention precludes pressure on the suture lines after vaginal plastic operations

and insures the absence of residual urine. I have no fear of an aseptic catheterization exciting a cystitis, but regard residual urine as a potential source of infection. When the patient voids for the first time, it is wise to catheterize immediately afterward for residual urine. If more than 20 cubic centimeters are recovered, the catheterization is repeated after each micturition until spontaneous evacuation is complete. Hexamethylenamine and acid sodium phosphate are prescribed early for all catheterized patients.

The incidence of postoperative pyelitis was lessened by pre-operative attention to indicanuria and colonic stasis.

The vesicovaginal fistula developed in an extremely anemic woman who was given two blood transfusions before a panhysterectomy for fibroids, adenomyosis, and a diseased cervix. Urine leaked from a pin point opening in the vaginal cicatrix on the eighth postoperative day, although voiding was not interrupted. The fistula closed spontaneously on the thirty-second day, and was undoubtedly due to a small area of thrombosis in the bladder wall, with subsequent necrosis.

Transitory hematuria appeared within 24 hours after a panhysterectomy and cleared up 48 hours later. There was no evidence of a renal lesion.

In series A, 9 urinary complications were regarded as preventable; in series B, only 3.

TABLE VII.—CARDIOVASCULAR COMPLICATIONS

	Series A	Series B
Thrombophlebitis.....	4	6
Embolism.....	3	0
Tachycardia.....	2	2
Acute cardiac dilatation.....	1	0
Auricular fibrillation.....	1	0
Endocarditis.....	0	1
Total.....	11	9

Thrombophlebitis followed vaginal operations twice, abdominal twice, and combined twice. The pelvic veins were involved once, the left leg three times, the right leg once, and both legs once.

Although embolism occurred but three times in series A, it did not occur at all in series B. Perhaps this was due only to extraordinary good fortune, but the practice of active motion of the extremities during con-

vaescence, as well as the postponement of operation in elective cases until the cardiovascular system is in the best possible condition, cannot be ignored as contributing factors. There were 179 abdominal hysterectomies in series A and 279 in series B, a total of 458, with only 1 death from embolism. They were all done rapidly with clamps, which certainly refutes the argument that it is necessary to putter with ligatures before the uterus is removed for fear of possible embolism.

Tachycardia was noted in 2 patients who were free from hyperthyroidism and organic heart disease, coming on within the first 24 postoperative hours. It persisted for 5 days in 1, and 3 days in the other.

Endocarditis was revealed at autopsy in a profoundly septic patient.

None of these cardiovascular complications seems to have been preventable.

TABLE VIII.—SYSTEMIC COMPLICATIONS

	Series A	Series B
Surgical shock.....	2	2
Acidosis.....	2	1
Uremia.....	1	0
Alkalosis.....	1	0
Thyrototoxicosis.....	1	1
Total.....	7	4

Surgical shock can be greatly restricted by the free use of pre-operative blood transfusions. Transfusions are given to all patients on my service with a red cell count of 3,500,000 or less, or hemoglobin of 60 per cent or less, and all septic or debilitated women. They were so used in 35 patients in series B. The 2 cases of shock in series A occurred in septic patients; the 2 in series B developed after prolonged and technically difficult laparotomies.

The patient in series B who developed acidosis was an advanced diabetic with a hopeless carcinoma of the cervix, who died 10 days after admission. She really should have died on the medical service. I have a great many diabetic candidates for operation, and usually have no difficulty in converting them into favorable prospects by rest in bed, dietary restrictions, and the use of insulin.

Thyrototoxicosis occurred in a patient after curettage who had been referred by the sur-

gical department for therapeutic abortion because of hyperthyroidism.

I know of no way in which these systemic complications could have been prevented.

TABLE IX.—POSTOPERATIVE HEMORRHAGE

	Series A	Series B
Postoperative hemorrhage.....	3	4

A postoperative hemorrhage is always humiliating. In series B the first consisted of bleeding from the abdominal wound 24 hours after operation, and must have been due to stabbing a superficial vessel in closing the skin. The second arose from the cervical stump 8 days after a supravaginal hysterectomy in a luetic patient, and was probably due to necrobiosis. The third came from the cervical stump 6 days after a Schroeder amputation, despite the use of 40 day chromic catgut. The fourth consisted of oozing on the eighth day from the suture line over an anterior colporrhaphy. They were all easily controlled; three of them were preventable.

TABLE X.—MISCELLANEOUS COMPLICATIONS

	Series A	Series B
Parametritis.....	0	3
Abscess of thigh.....	0	1
"Ether eye".....	0	1
Postoperative psychosis.....	0	1
Abscess of nasal septum.....	0	1
Total.....	0	7

A unilateral parametritis followed a hysterectomy and salpingo-oophorectomy for fibroids in 3 cases, in all of which it was necessary to invade the cellular connective tissue of the parametrium to enucleate tumors. The parametritis was recognized promptly and in all it cleared up under treatment before the suppurative stage.

An abscess of the thigh developed following a hypodermoclysis of glucose, given by the resident because the patient was in mild shock, and he could not penetrate a vein. There is now a standing order that nothing but normal saline solution or Ringer's solution shall be given by hypodermoclysis.

One patient suffered from acute conjunctivitis of one eye immediately after reacting from the anesthesia. This was certainly the fault of the anesthetist, and not that of the operator.

TABLE XI.—MORTALITY IN ONE THOUSAND CONSECUTIVE GYNECOLOGICAL OPERATIONS

No.	Diagnosis	Operation	Cause of death
1	Secondary anemia, fibromyoma of uterus, pelvic adhesions	Transfusion of 500 c. cm. of blood, supravaginal hysterectomy, and bilateral salpingo-oophorectomy (gas-oxygen anesthesia)	Simultaneous cessation of respiration and heart beat as the peritoneum was being closed, 22 minutes after the operation was started. No autopsy. (Anesthetic death?)
2	Diabetes, destruction of portio after cauterization by another operator, advanced carcinoma of cervix	Biopsy (gas-oxygen anesthesia)	Diabetic acidosis, 10th day
3	Cirrhosis of liver	Exploratory laparotomy (insisted upon by internist), evacuation of ascitic fluid (gas-oxygen anesthesia)	Esophageal hemorrhage, cirrhosis of liver, 12th day. Autopsy
4	Tubal pregnancy	Right salpingectomy (gas-oxygen-ether anesthesia)	Two convulsions in rapid succession on 7th day after afebrile convalescence. Death 5 minutes later. Diffuse renal degeneration. Autopsy
5	Lacerated perineum, pelvic adhesions, retroflexion of uterus, chronic appendicitis, dilatation of cecum	Perineorrhaphy, mobilization of viscera, Crossen suspension of uterus, appendectomy, plication of cecum (spinal anesthesia)	Wound dehiscence, 8th day. Wound resutured under local anesthesia. Died 18th day. General purulent peritonitis, bilateral pulmonary atelectasis, fatty liver infiltration. Autopsy
6	Degenerated cervical fibroid, pelvic abscess, septicemia	Vaginal myomectomy, posterior colpotomy (followed by blood transfusion) (gas-oxygen anesthesia)	Died 5th day. Ruptured pyosalpinx, ileus, peritonitis, endocarditis. Autopsy
7	Adenocarcinoma of ovary, ascites	Pre-operative transfusion, bilateral salpingo-oophorectomy (gas-oxygen-ether anesthesia)	Peritonitis. Death on 6th day
8	Fibromyoma of uterus, ovarian cyst, chronic appendicitis	Supravaginal hysterectomy, right salpingo-oophorectomy, appendectomy (gas-oxygen-ether anesthesia)	Postoperative shock in 6 hours. Transfusion. Died, 19 hours. Internal hemorrhage. Autopsy

One patient operated on for bilateral papillary cystadenocarcinoma of the ovary developed a transitory psychosis on the sixth day which cleared up within a month.

An abscess of the nasal septum can hardly be considered a true postoperative complication after a laparotomy, but in one case it was responsible for an obscure postoperative pyrexia, which subsided after drainage of the pyrogenic focus.

MORTALITY

The first case was a death during operation, called an "anesthetic death" by the expert anesthetist who administered the ether, and may be regarded as one of the accidents of surgery.

The second and third patients were in a desperate condition and really belonged on the medical service. Neither operation was approached with any enthusiasm.

The fourth death was inexplicable, as the autopsy failed to reveal the cause of the convulsions, and the "renal degeneration" was a microscopical diagnosis.

In the fifth case the spinal anesthesia was unsatisfactory and had to be supplemented with nitrous oxide gas-oxygen. The obese

patient retched and strained throughout the primary operation. Perhaps this was a factor in the subsequent wound disruption. Spinal anesthesia was used 72 times in this series of 1000 cases, and in only 3 was the relaxation unsatisfactory.

The sixth patient was too sick on admission to justify a laparotomy, and when her hyperpyrexia was unaffected by the posterior colpotomy and pelvic drainage, the prognosis became grave indeed.

The seventh patient was a debilitated elderly woman whose abdomen was so distended by the tumors and fluid that dyspnea was marked. She demanded relief, realizing the risks involved.

The eighth death was due to my personal obstinacy. At 4 p.m. after operation the patient's pulse rate was 90, and remained so until 8 p.m. The rate then increased and reached 120 within an hour. A glucose infusion was given at 10 p.m. and a blood transfusion at 12 midnight. There was no restlessness or air-hunger, and I could not believe that she was bleeding internally, because I always secure the ovarian and uterine vessels with transfexion ligation, and assure myself that the field is absolutely dry before closing

the abdomen. The autopsy revealed an internal hemorrhage apparently arising from the right side of the top of the cervical stump beneath the area covered by the bladder. Histological examination of the cervical stump showed that the uterine artery and vein were firmly encircled and compressed by the ligature.

In series A, 5 of the 19 deaths were regarded as preventable. In series B only 1, the eighth, can be so designated.

CONCLUSIONS

1. Having conscientiously scrutinized a previous series of 1000 consecutive personal gynecological operative cases, it has been possible to effect a 34 per cent reduction in morbidity and a 57 per cent reduction in mortality. In the second series of 1000 there was morbidity in 53 patients and 8 patients died.

2. Gentleness in separating bowel adhesions, recognition of endometriosis of the rectovaginal septum, refusal to irradiate any patient suspected of harboring a latent pelvic infection, careful peritonealization of raw surfaces, and the use of sheets of gutta-percha tissue to cover surfaces that cannot be peritonealized will obviate fecal fistulas and postoperative intestinal obstruction.

3. The routine administration of 10 per cent carbon dioxide in oxygen just before the completion of the operation will minimize the incidence of pulmonary complications in general, and pneumonia in particular.

4. Dehiscence of an abdominal wound is probably due to tissue hunger and proteolytic digestion of catgut before fibro-plastic production is sufficient to splint the wound, rather than to defective suture material.

5. Approximation of the vaginal fibers of the levator ani muscles with kangaroo tendon and a subcuticular suture of the skin margin evidently minimize perineal wound infections.

6. Keeping the bladder free from residual urine lessens the incidence of postoperative cystitis. Residual urine is more of a menace than aseptic catheterization.

7. Postponing elective operations until the cardiovascular system is in the best possible condition, and the frequent practice of active motion of the extremities throughout convalescence will practically eliminate postoperative embolism.

8. Removing the uterus by applying clamps instead of preliminary ligatures is a safe procedure.

9. Pre-operative blood transfusions should be utilized in all cases of anemia, debility, or sepsis.

10. Invasion of the cellular connective tissue of the parametrium for the removal of intraligamentary tumors predisposes to subsequent parametritis.

11. Glucose should always be administered intravenously, never subcutaneously.

12. It should be the aim of every pelvic surgeon to limit his postoperative morbidity and mortality to an irreducible minimum.