Discussion

In the development of this technique of hypothermic perfusion blood and plasma were early abandoned; their value as nutritional and gas-exchange media was outweighed by problems related to viscosity changes at low temperature. It was found that adequate gas exchange was possible at 5°C using water-based solutions only. The lack of oncotic pressure in these solutions was counteracted by the use of dextran (molecular weight 70,000), and low perfusion pressures. The buffering capacity of blood was adequately replaced by Krebs's solutions, normal and pH values being maintained throughout by control of the CO2 content of the added gas, and metabolic acidosis did not occur during 72 hours of perfusion. Glucose metabolism continues (Fuhrman and Fuhrman, 1964) we add insulin empirically. Hydrocortisone was used, equally empirically at this stage, for its stabilizing effect on the cell membrane. Logically, if an asanguineous solution is to be used for extended storage, then tissue culture media would be expected to be more suitable. Ultimately this may be so, but in our hands the results with TC 199 medium were not as good as with the modified Krebs's solution. We are convinced that, even with water-based solutions, microemboli contribute to the decline in function with time of organs perfused on a closed circuit. Pre-filtration is of some value, but continuous filtration is required to protect the heart from the debris due to aggregates of precipitates, cells, and as yet unidentified homogenous material that accumulates in suspension. To this end we have used a filter in line with the heart, of a porosity comparable to that of the capillary bed. A disadvantage of this technique is that the heart is extremely sensitive to impurities in a closed-circuit perfusion, and only rigorously cleaned Pyrex-type glass filters should be used.

The ultimate measure of viability of the preserved heart is its capacity to fully support the circulation after orthotopic transplantation. Ethically this cannot be a test of function, and the viability should already be known at all times before and during storage. With preservation of the heart it is anticipated that the sequence of events between removal and insertion of the organ would be: (1) resuscitation of the heart to a pre-determined standard, (2) storage of the heart in the optimal mode, and possibly (3) restoration of the heart to a "normal" physiological state for assessment of mechanical function. With the development of reliable criteria of viability during storage this latter stage may be dropped. The coronary resistance is likely to become such a criterion.

ADDENDUM: The electron-microscope studies have confirmed the normal light-microscope histology of the stored hearts.

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REFERENCES


Medical Memoranda

Concurrent Ovarian and Intrauterine Pregnancy

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Concurrent ectopic and intrauterine pregnancy has been known since 1708, when Duverney, in France, reported the first case diagnosed at necropsy. Smith (1961), in a review of the history of this condition, computed a total of 482 cases. When the ovary is the site of the concurrent ectopic implantation the condition is rare and reports of such cases include those of Milnor and Bowles (1940), Hertig (1951), Rannels (1953), Lawson and Chouler (1955), Mulla and Johns (1958), and Smith (1961). The following case is worth recording because of its rarity and also because the ovarian pregnancy was of some 16 to 18 weeks' gestation, while the intrauterine pregnancy continued with eventually a successful outcome.

Case Report

A married woman aged 21 was seen by me on a domiciliary consultation at 7 p.m. on 2 November 1965. At 2 a.m. that day she had been awakened by continuous pain in the epigastric and umbilical regions. Nausea was present, but she had not vomited. Attempts to lie flat aggravated the pain, which was referred to both shoulders. There was no history of trauma. Micriturbation was normal; her bowels were regular and had moved normally that morning. Her menses were very regular, with a cycle of 4/28; her last period began on 20 June 1965—that is, she had had 18 to 19 weeks' amenorrhoea. She had already consulted her general practitioner, who had diagnosed pregnancy, and arrangements had been made for domiciliary confinement. After eight weeks' amenorrhoea she consulted her doctor because of lower abdominal pain, particularly on the right side. Bacilluria (Escherichia coli) was found and a diagnosis of right pyelonephritis made. Treatment was by a six-day course of nitrofurantoin 100 mg. six-hourly. At 12 weeks' amenorrhoea she had an episode of diarrhoea and vomiting, which was diagnosed as gastroenteritis, there being
an epidemic at the time. Apart from these two episodes she remained well until the present complaint. She had had two previous full-term normal deliveries in 1961 and 1963. There had been no previous illnesses or operations.

On examination she looked pale and tense. The temperature was 97.5° F. (36.4° C.). Pulse was rapid, of rather poor volume, the rate being 130 a minute. Blood pressure was 115/78 mm. Hg. Heart and lungs were normal. Any attempt to lay her flat for abdominal examination caused her to complain bitterly of pain radiating into the upper abdomen and both shoulders. At the same time her pallor increased and her pulse quickened. The abdomen was therefore examined with the patient in the semirecumbent position, when a general distension was noted, and a tumour having the size and consistency of an 18-week pregnant uterus was felt rising from the pelvis to just below the umbilicus. There was marked tenderness all over the abdomen, maximal above and to the right of the umbilicus. There was no rebound tenderness, guarding, or rigidity. Dullness to percussion was elicited in both flanks and occasional bowel sounds were heard. On vaginal examination the cervix felt soft with the external os closed, and there was no bleeding. Speculum examination was not carried out. Both per vaginam and per rectum acute tenderness was elicited throughout the pelvis.

It was obvious from the history and examination that the patient had sustained a progressive internal haemorrhage of some severity, and urgent admission to hospital for laparotomy was arranged, operation being undertaken one and three-quarter hours after she had been seen at her home. Her haemoglobin was 9.2 g./100 ml. (63%) and urinalysis was normal.

When the peritoneal cavity was opened a cystic haemorrhagic mass was found with the greater omentum adherent to it. Fresh fluid and clotted blood totalling 1,500 ml. were evacuated from the paracolic gutters, and closer inspection of the mass revealed a rupture, 2.5 cm. in length, with active bleeding from obvious placental tissue. The adherent omentum was separated and further exploration showed that the mass was cystic and appeared to be separate from an enlarged uterus. The mass was therefore reduced in size by aspirating clear amniotic fluid, which allowed it to be delivered into the wound without difficulty. Accurate inspection of the mass and adjacent organs was now possible, and it was then realized: (a) that the uterus was the size and consistency of an 18-week pregnancy; (b) that the cystic mass was a ruptured ectopic pregnancy which had been implanted in the right ovary—when opened on the operating-table the mass contained a 16-18-week fetus of normal development to the naked eye, though the sex was indeterminable but more likely to be male from inspection of the external genitalia; (c) that the right tube appeared normal and was quite separate from the cystic mass which occupied the position of the left tube and ovary; (d) that the right ovarian ligament—obvious ovarian tissue was present in the wall of the mass, so that the criteria of Spiegelberg (1878) for a primary ovarian pregnancy were fulfilled; and (e) that the left tube and ovary were normal and there was no naked-eye evidence of a recent corpus luteum in this ovary.

The right tube and ovarian pregnancy were removed together with a normal appendix, and during the operation 1,200 ml. of compatible blood was transfused. Recovery from the operation was uneventful, quickening being noticed 48 hours after operation. She was discharged on 12 November, when her haemoglobin was 8.6 g./100 ml. (59%). This anaemia was treated with oral iron and arrangements were made to book her for hospital confinement.

Routine blood tests revealed the presence of Rh antibodies anti-D and anti-E, the former in a titre of 1 in 20 on 1 February 1966 and 1 in 40 on 18 February. Her blood group was A Rh-negative Cde/cde and that of her husband A Rh-positive CDe/cde (heterozygous). Surgical induction undertaken at 38 weeks’ gestation was followed by the normal delivery of a male infant weighing 3,250 g. from whom the following results were obtained: cord blood haemoglobin 13.1 g./100 ml. (89%); blood group A Rh-positive; direct Coombs positive, indirect Coombs (mother and baby) strongly positive; total serum bilirubin 2.9 mg./100 ml.; conjugated bilirubin 0.4 mg./100 ml.; haemoglobin 6.4 g./100 ml.; haemoglobin 2.5 mg./100 ml. Clinical jaundice appeared on 15 March and the serum bilirubin rose to 27 mg./100 ml., so an exchange transfusion of 600 ml. was carried out. The infant’s condition was subsequently satisfactory and he was discharged 19 days after delivery on oral iron, his haemoglobin being 73% and weight 3,250 g. The mother had been discharged from the hospital on 19 March, after having donated 400 ml. of blood.

**Discussion**

A clinical diagnosis of primary ovarian pregnancy is generally regarded as well-nigh impossible preoperatively. In the first two months or so, when most of them cause abdominal symptoms necessitating laparotomy, bleeding from a tubal pregnancy or corpus luteum is usually thought of first. In cases that proceed to term, an event more likely in the ovary than in the tube, the diagnosis is usually that of ovarian cyst. One must agree with the comments of Gérin-Lajoie (1951) when he states that histological examination is indispensable in formulating a diagnosis; but the macroscopic details of the removed specimen in this case left no doubt in my mind, and I wished to preserve a perfect museum specimen.

The diagnosis of concurrent ovarian and intrauterine pregnancy must be even more difficult and it was not made preoperatively in any of the cases quoted above. In this case there was no doubt that intraperitoneal bleeding was present, and the possibility of it being from an ectopic pregnancy did not enter my head, as I was convinced clinically of the intrauterine pregnancy corresponding to the dates given, and therefore considered bleeding from a corpus luteum more likely. In retrospect some disaster to a secondary abdominal pregnancy should have been considered before the corpus luteum, as the latter usually degenerates from the 12th week.

The fate of the intrauterine pregnancy depends to some extent on the stage it has reached when operative treatment is required for the concurrent ovarian pregnancy, the manipulations involved in such treatment, and whether the corpus luteum of pregnancy is removed with the ovary. In the case recorded by Lawson and Chouler (1955) the intrauterine pregnancy of six weeks’ gestation ended in abortion 10 days after oophorectomy, the ovary containing the corpus luteum. In Mulla and John’s (1958) patient ovarian pregnancy was found at operation for sterilization three days after delivery. The ovary contained a 2-cm. long necrotic embryo. The other four cases quoted produced living infants at term, the ovarian pregnancies being operated on at from 8 to 14 weeks’ gestation. Regarding the continuation of the intrauterine pregnancy in this case, I am tempted to speculate that the rupture through the placental site in the ovary might have resulted in a transfusion of foetal red cells sufficient to sensitize the mother to Rh antigens, with the subsequent development of haemolytic disease in the infant.

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**References**


