

A report of 300 cases using vacuum aspiration for the termination of pregnancy

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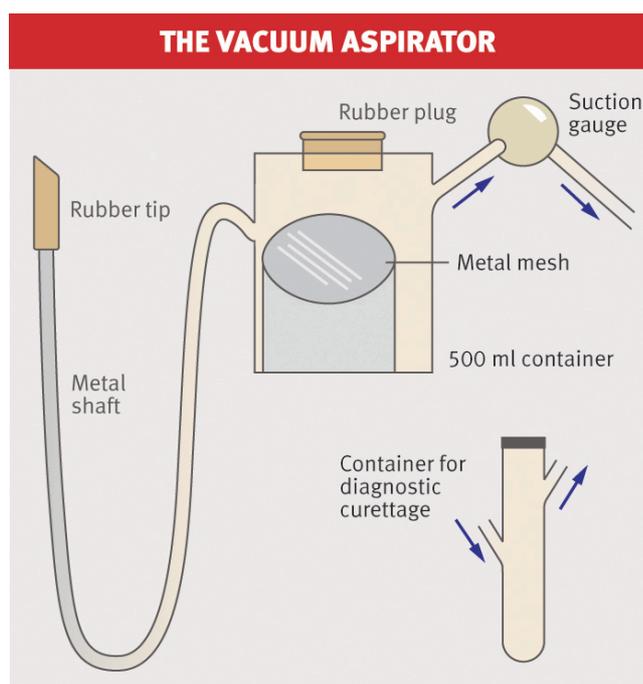
More than 100 years after Recamier first invented curettage in 1844, it remains widely used by all gynaecologists for a variety of reasons. However, in spite of the numerous benefits of curettage, complication rates are high—perforation of the uterus, severe haemorrhage, pelvic inflammatory disease, damage to the endometrial basal cell layer resulting in amenorrhoea, infertility, placenta accreta, etc.

By chance, the authors met at a small conference and discussed the use of curettage for abortion and its failings. We felt that we could design a vacuum aspirator made of rubber and use it as a safe alternative to a metal curette, thereby reducing the associated trauma.

The vacuum aspirator: basic design, advantages, and disadvantages

Design

Each device was initially handmade. Despite subsequent modifications, the design remained imperfect. Based on this original design we eventually developed a vacuum aspirator in cooperation with a research institute for the development of medical devices (figure 1).



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1. The rubber tip is the most important part of the whole device. 150 successful abortions were performed with a metal shaft of 7 mm internal diameter, using a 4 cm rubber catheter tip of 5mm inner diameter. . . The angle of the tip was most important in determining the degree of suction. We found that 40 degrees was best. The bigger the angle, the greater the probability of haemorrhage.
2. The metal shaft was necessary to control the movement of the catheter in the uterus. . . we found that the 7 mm internal diameter shaft was best. The only problem was that the cervix has to be dilated up to 9mm, which may make the patient uncomfortable.
3. The container. A 500 ml sterile container with a metal screen was used so that the blood collected at the bottom, whilst the products of conception remained on the mesh. These can be identified by an experienced operator.
4. The suction. The best form of vacuum is produced hydraulically or by an electric pump. The power of the suction is a key factor in the extraction operation. The suction should be around 0.25 horsepower.

Our experience

1. One abortion was performed by hysterotomy at the third month of pregnancy. We used a metal aspirator . . . to extract the conceptus under direct vision and this proved to be successful.
2. One abortion was performed on a two month pregnancy using a Novak curette with suction. However, the 2 mm internal diameter tube became blocked, so the abortion had to be completed by curettage.
3. 50 abortions of 40-70 day pregnancies were performed using a rubber catheter of 8 mm internal diameter . . . The angle of the tip was 40 degrees and the cervix was dilated to more than 12 mm . . . For the early stages of pregnancy, the extraction was successful the first time but at later stages of gestation, it had to be repeated because the placenta obstructed the catheter . . . Reorientation of the catheter is necessary if there is only decidual tissue in the container. Curettage was used at the end of the procedure as a confirmatory check. 60% of these operations were successful, while there were remnants of products of conception in the remaining 40%. Probable causes of failure are likely to be operator-dependent and lack of a sufficiently flexible rubber catheter. During the procedure we observed minimal haemorrhage . . . in general the quantity of blood loss was

observed to be 20-30 ml . . . including amniotic fluid. Subsequent bleeding after the procedure was minimal and less than that caused by curettage . . .

4. 50 abortions of 40-85 day pregnancies were performed with a metal shaft of 7 mm inner diameter and a rubber tip of 5 mm inner diameter. The angle of the bevel was the same as the above. The cervix was dilated to 9 mm . . . and all the operations were completed in 2-3 minutes with optimal results. The amount of bleeding, including amniotic fluid, was an average of 50 ml. A final check by curettage was performed before the end of the procedure . . . overall there were minimal products of conception found during the check. There was a very high success rate with this method.
5. 50 abortions were performed with metal shafts of various inner diameters . . . however, the angle of the bevel remained the same. The cervix was dilated as wide as needed, but the results were less promising. The success rate was 20%, while large pieces of the conceptus remained in utero in the other 80%. In some cases, excessive haemorrhage of up to 500 ml occurred . . .
6. 18 abortions were performed with a metal shaft of 2 mm inner diameter . . . and a rubber tip. The bevel remained the same and hydraulic suction power was used. The cervix was dilated to 6.5 mm, and the procedure lasted for . . . an average of 25 minutes. The quantity of bleeding averaged of 40 ml. A final check by curettage was performed at the end of every procedure . . .
7. 25 procedures were performed on incomplete abortions. Rubber cannulas of 8 mm inner diameter were used with no cervical dilatation necessary . . . the results were generally positive. Only the necrotic placenta was extracted, so the uterine mucosa remained intact, which reduced the possibility of pelvic inflammatory disease.
8. 5 operations were performed for diagnostic curettage. Metal cannulas of 2 mm inner diameter were used with rubber tips, with the same angle of the bevel as above. Suction with 0.125 horsepower was used and the procedure lasted for 1-2 minutes with a very high success rate.

Brief summary

1. Pelvic inflammatory disease occurs after curettage for spontaneous or incomplete abortion, however, vacuum extraction rarely results in this complication. It may still be too early to prove this conclusively without carrying out further experiments . . .

2. For diagnostic curettage, the patient has to be in hospital for 1-2 days, and the procedure has to be performed in an operating theatre. Using vacuum extraction for the same purpose, the procedure can easily be carried out in a mobile clinic without any medication needed (the cervix is only slightly dilated), in a few minutes.
3. Hydatidiform moles were not observed in any of our patients . . .
4. With regards to using vacuum aspiration for the purposes of induced abortion:
 - a. Catheters with inner diameters larger than 7 mm are satisfactory for pregnancies of less than 70 days.
 - b. Catheters of 2 mm inner diameter are satisfactory for pregnancies less than 50 days . . .

Initial experience and analysis of vacuum aspiration

1. We initially postulated that the potential complications caused by vacuum aspiration would be uterine inversion, severe haemorrhage, desquamated endometrium, etc. Once we attempted to induce uterine inversion after hysterectomy and found that it would require an extremely high suction. Of course we acknowledge that there must be a difference between an excised uterus and one containing an embryo. During the first operation where the abortion was performed by hysterotomy, we observed that the conceptus and decidua were easily extracted and desquamated, while the endometrium was not. And even after forcible extraction it was difficult to desquamate the endometrium. In the case of a hysterectomy performed on one patient with endometrial hyperplasia and dysfunctional uterine bleeding, we subsequently used the vacuum aspirator to remove the hyperplastic endometrium. We observed that the pathological endometrium was easily sucked out whereas the normal endometrium was not. Severe haemorrhage only occurred in 14 of the 300 experimental procedures performed, but after some modifications (as described previously) this complication no longer occurred.
2. There were 14 patients who experienced bleeding of over 150mls, with one patient losing 500ml of blood (3 month pregnancy). However, for all 300 cases the average amount of bleeding was 150-300ml. All the 14 cases of severe haemorrhage occurred in the first two weeks of our trial, when the angles of the bevels on the rubber tips exceeded 40° or even 60°, combined with insufficient suction power (0.125 horsepower). Subsequently the angle was reduced to 40°, coupled with a more powerful

suction of 0.25 horsepower. The haemorrhagic complications were thus eliminated. We concluded that the cause of severe bleeding was incomplete placental separation due to insufficient suction.

3. Several suggestions to guarantee the success of the procedure:
 - i. There should be space to allow air flow into the uterus during the procedure. We first tried fluting the rubber cannula, then using a flat metal cannula, but the results from both were less promising than expected. We finally dilated the cervix 1.5-2mm wider than the external diameter of the cannula and succeeded.
 - ii. Excessive suction power: The power of the suction should be moderate. Too much may injure the lining of the uterus, and too little is insufficient for extraction. The suction should enable the conceptus to be extracted when the tip is 0.5-1 cm away from it. This exact figure is yet to be calculated.
 - iii. The bevel of the rubber tip should be placed close to the conceptus and the uterine wall. At the beginning we thought a larger bevel and a cannula with a wider inner diameter would ensure better extraction, but we were proved wrong in subsequent experiments. We realized then that the bevel should fit the lining of the uterus and be closely adjacent to it to ensure that there is no air leak when the extraction is initiated.
 - iv. Every aspect of the uterus should be explored thoroughly. The extraction is similar to curettage in this respect... However the benefit of vacuum extraction is that the suction apparatus enables wider exploration (a circular surface area up to 0.5 cm radius from the rubber tip) as compared to curettage, which only works at the exact point of contact. For practical purposes, we divided the walls of the uterine cavity into 8 segments and explored each segment with a cannula of 7mm inner diameter for 1-1.5 minutes. This can be repeated 2-3 times if necessary. We used curettage as a final check for all cases, and found that the method described above worked perfectly to ensure complete extraction. However we recommend that more experiments are done to confirm this finding and improve our method.
4. Regarding the effectiveness of vacuum aspiration at various stages of pregnancy: the earliest stage of pregnancy among the 300 experimental cases was 42 days and the latest was 3 months. We found that vacuum extraction worked better in the earlier stages of pregnancy, with a 100%

success rate for all cases with pregnancies of less than 50 days. The results of vacuum extractions for pregnancies more than 50 days were less predictable. There were cases with later pregnancies when massive haemorrhage occurred frequently, and the extraction was stopped and curettage was used to complete the procedure. We have yet to gain sufficient experience about the effect of vacuum extraction on pregnancies at a gestational stage later than 70 days. Ever since we started using cannulas of 7mm inner diameter, we attempted performing vacuum extraction on 70-85 day pregnancies. Using the suction powered rubber tipped catheter we decompressed the fetal contents before vacuum extraction. This proved successful in the end.

5. Regarding the side effects of vacuum aspiration on subsequent menstrual periods: due to practical time constraints, follow-up research has not been done and long term complications and effects on subsequent menstrual cycles will be reported in the future.

Final conclusions

1. Vacuum abortion can avoid perforation of the uterus, for two reasons. Firstly, the rubber tip is much softer than a metal curette, and secondly negative pressure from the suction causes collapse of the uterine wall, making it much firmer. Out of 300 abortions performed, there was only one case where the uterus was perforated. After laparotomy, the cause was found to be due to the cervical dilator, not the vacuum aspirator.
2. Damage to the uterine mucosa caused by vacuum abortion is far less than that caused curettage.
3. Vacuum abortion will not cause damage to the uterine mucosa that could potentially lead to pelvic inflammatory disease.
4. The bleeding caused by vacuum abortion is generally less than 50ml, as compared to heavier bleeding caused by curettage.
5. The curettage procedure lasts 30-60 mins after the cervix is dilated up to 12 mm. The vacuum abortion requires only 15-20 minutes including cervical dilation.
6. Successful curettage is operator-dependent, whereas the outcome of vacuum abortion is more standardized.

7. Patients did not report any pain during the vacuum abortion, whereas painful facial expressions were observed during the final check with curettage.
8. Morphine was given to patients as analgesia before curettage and oxytocin was given to avoid perforation of the uterus during this procedure. With vacuum extraction both medications were unnecessary, and the outcome was more promising.
9. In all 300 cases, half of the patients left the hospital 3-4 hours after the procedure. Patients did not have to stay in the hospital for long because they experienced less haemorrhage and no morphine was administered.
10. The use of disinfectant swabs was greatly reduced – no more than 3 were needed for each procedure.
11. The use of vacuum abortion can avoid the complications caused by curettage, and the time taken to perform one abortion is greatly reduced. A gynaecologist can perform 10 terminations of pregnancy in 3 hours, which is a great improvement compared to previous practice, and meets the public health demands of being cost-effective and time-efficient.

Authors' note

Most of the 300 procedures were performed at the central hospital of Ti Lan Qian district (about 200 cases). The remainder were performed at other public hospitals, and a few were performed at Nan Yang Hospital.