patients and in-patients. A negative phenistix test is evidence that no appreciable amount of P.A.S. is present in the urine and that no P.A.S. has been taken for 12 to 18 hours.

Of a total of 444 tests at unexpected times on hospital in-patients receiving P.A.S., 436 (98%) gave a positive and 8 (2%) a negative result. Not all patients in hospital can be relied on to take their medicine unless the nurse makes sure that the medicine is actually swallowed.

Of 705 tuberculous out-patients on P.A.S. therapy, 467 gave a positive phenistix result, and the remaining 238 (34%) were "defaulters." Negative results were found in 39% of the women and 30% of the men. The length of time that patients had been taking chemotherapy and the time elapsing since discharge from hospital had a significant effect on the results. The failure rate steadily increased in both instances with each year of the duration of chemotherapy. It is inadvisable to permit young adults aged 15–24 of either sex, females aged 25–44, and males over the age of 55 to leave hospital after only a short stay, as patients in these age-groups showed the highest default rates.

Self-testing by 20 patients revealed the reasons for negative tests and gave insight into patients' drug-taking habits. The problem of self-administration of drugs is discussed. It is suggested that the best results will be obtained in cases where the whole course of treatment is directed by one experienced physician and that continuity of medical surveillance is essential.

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REFERENCES

Baird, H. W. (1958). *J. Pediat.*, **52**, 715.
Baron, D. N., and Newman, F. (1958). *Brit. med. J.*, **1**, 980.
Campbell, G. D., and McNeill, W. G. (1959). Ibid., **2**, 633.
Cosnett, J. E. (1959). Ibid., **1**, 187.
Dixon, W. M., Stradling, P., and Wootton, I. D. P. (1957). *Lancet*, **2**, 871.
Expert Committee on Rheumatic Diseases (1957). *Wld Hlth Org. tech. Rep. Ser.*, No. 126.
Fox, W. (1958). *Tubercle (Lond.)*, **39**, 269.
Frazer, S. C. (1958). *Brit. med. J.*, **1**, 981.
French, J. M., Hawkins, C. F., and Smith, N. (1957). *Quart. J. Med.*, **26**, 481.
Gibbs, N. K., and Woolf, L. I. (1959). *Brit. med. J.*, **2**, 532.
Hawkins, C. F., Peeney, A. L. P., and Cooke, W. T. (1950). *Lancet*, **2**, 387.
Herold, K. (1951). *Klin. Wschr.*, **29**, 199.
Lauener, H., and Friedrich, T. (1958). *Lancet*, **1**, 592.
Luntz, G. (1957). *Brit. med. J.*, **1**, 499.
Macgregor, A. G. (1958). Ibid., **2**, 430.
Nellhaus, G. (1959). *J. Amer. med. Ass.*, **170**, 1052.
Penman, H. G., and Wraith, D. G. (1956). *Lancet*, **2**, 552.
Rheumatic Fever Committee of the Royal College of Physicians (1957) Further Report.
Ruiz, R. C. (1957). *Tubercle (Lond.)*, **38**, 152.
Rupe, C. O., and Free, A. H. (1958). Proceedings of National Meeting of Div. of Biol. Chem., *American Chemical Society, Chicago, 134th meeting: Abstracts of Papers*, p. 63C.
Simpson, J. McD. (1956). *Tubercle (Lond.)*, **37**, 333.
Tuberculosis Chemotherapy Centre, Madras (1959). *Bull. Wld Hlth Org.*, **21**, 51.
Tuberculosis Society of Scotland (1958). *Tubercle (Lond.)*, **39**, 129.
Venkataraman, A., Venkataraman, P. R., and Lewis, H. B. (1948). *J. biol. Chem.*, **173**, 641.
Wilkinson, J. F. (1949). *Lancet*, **1**, 291.
Wynn-Williams, N., and Arris, M. (1958). *Tubercle (Lond.)*, **39**, 138.

USE OF A VACUUM EXTRACTOR (VENTOUSE) IN OBSTETRICS

BY

J. A. CHALMERS, M.D., F.R.C.S.Ed., F.R.C.O.G.

AND

R. J. FOTHERGILL, M.B., Ch.B., D.Obst.R.C.O.G.

Department of Obstetrics, Ronkswood Hospital, Worcester

For at least 250 years attempts have been made to shorten labour by means of traction applied to the foetal head. Early in the seventeenth century the obstetric forceps was invented by the Chamberlin family, and modifications of it are in use throughout the world to-day. As an alternative, the use of a vacuum to affix a tractor to the foetal scalp has been attempted since Yonge used a cupping glass in 1706. The next attempt of the kind appears to have been that of Simpson, in 1849, who described a rubber cap attached to a brass syringe. In 1890 MacCahey used a rubber cap with a solid handle which was pressed on to the presenting part and created its own vacuum.

Torpin (1938) reported the delivery of 10 women with prolonged second stage by means of a rubber suction cup extracted by a vacuum pump, and bearing a loop for traction and lugs which enabled the operator to aid rotation. In 1947 Couzigou described the use of a metal cup, which he called the "ventouse," the name now in general use in the French-speaking countries. Koller (1950) applied prolonged weight traction to the foetal head in cases of uterine atony by means of a suction cup, and with a weight of 0.5–1.5 kg. for up to 18 hours achieved augmentation of the uterine contractions and acceleration of the labour. An apparently unique use of the vacuum principle was that of Gastaldo (1951), who occluded the lower birth canal with a metal cup covered with rubber. Subsequent creation of a vacuum was said to promote advance of the foetus down the birth canal. Finderle (1952) described his trumpet-shaped metal cup extracted by a vacuum pump, and in 1955 he reported that the instrument had replaced forceps completely for three years and that in 132 deliveries no deaths or complications were attributable to the extractor.

Malmström (1954) described his instrument, which was used primarily to increase labour pains in inertia by promoting good contact between scalp and cervix and so leading to increased stimulation of the uterus. Prolonged weight traction for up to several hours was originally used, but, later, direct extraction or improvement of the position of the head for subsequent forceps delivery was undertaken. Later, Malmström (1957a) described the modification of his instrument which is now the form most widely used. Since his first report his instrument has been used in many European countries, including Russia (Petchenko, 1958), North and Central Africa, China, and South America. We have been unable to find any report of its use in either the British or the North American literature, though at the Second World Congress of Obstetricians and Gynaecologists in Montreal in 1958 films demonstrating its use were shown by Muller, of Strasbourg, and deWatteville, of Geneva.

The only British references we have found are in nursing publications. Lobban (1955) claims that

mothers preferred this instrument to forceps, but observed that "it seems likely to receive a more conservative reception in Britain than elsewhere." Malmström (1957b) described his method at the Stockholm Congress of Midwives, and a report of his paper was subsequently published in England. Though the Malmström instrument was used initially for the application of prolonged traction in uterine inertia (Malmström, 1954; Aschan and Saloheimo, 1955), more recently this or similar instruments have been used increasingly for direct extraction and delivery. In many clinics it has largely replaced forceps (Blackman, Pierret, and Dussart, 1956; Sohie, 1957; Rosa and Piraux, 1957; Snoeck, personal communication, 1958; Bruniquel and Israël, 1958; Goldberg and Levy, 1958), but several authors think it should be used as a supplementary aid rather than as a substitute for forceps (Meinrenken and Schieferstein, 1957; Pigeaud, 1957; Dexeus, 1957).

The Ventouse

The instrument we have used is the modified Malmström vacuum extractor which has three metal cups, 20 mm. deep and 40, 50, and 60 mm. in diameter (Fig. 1). From a plate within the apex of each cup a chain passes inside a flexible rubber tube to a traction bar and is there secured by a pin. The rubber tube fits on to a metal tube traversing the traction bar, and from this a further rubber tube leads on to a vacuum bottle fitted with a screw-release valve. The bottle carries a manometer graduated up to 1 kg./cm.^{2} and is exhausted by means of a vacuum pump. On the two larger cups is a small knob which can be used either to promote rotation or merely as an indicator of the position of the cup.

Application.—The largest possible cup is inserted in much the same way as a ring pessary into the birth canal and applied to the presenting part, the perineum being pressed back either with the cup or with the fingers of the other hand. With a cephalic presentation the cup should be applied as far back as possible on the head in order to promote flexion, and care must be taken that the membranes are ruptured and that neither vaginal nor cervical tissue is interposed between the scalp and the cup. An artificial caput is now raised on the presenting part by the production of a vacuum within the cup of up to 0.8 kg./cm.^{2} This must be achieved by a gradual reduction of pressure, and 6 to 10 minutes are usually necessary to ensure complete filling of the cup by the scalp and therefore adequate adhesion. Traction is then applied in the axis of the pelvis by pulling on the traction bar with the right hand, two fingers of the left hand being used to displace the perineum, to control adhesion of the cup, and if necessary to push the head towards the hollow of the sacrum or to promote flexion. Traction should usually coincide with pains, and delivery is completed in the usual way with or without episiotomy as required. Reduction of pressure by opening the screw valve permits detachment of the cup from the foetal scalp.

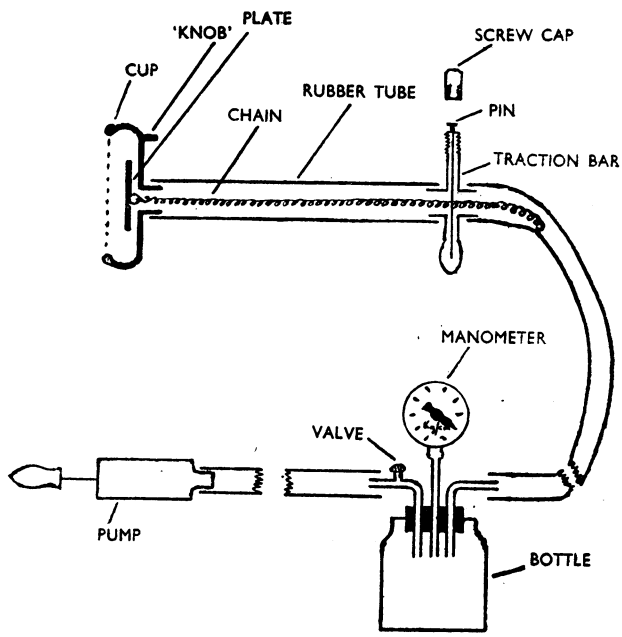

FIG. 1.—Modified Malmström vacuum extractor.

Anaesthesia.—In many cases no anaesthesia is required (Blackman *et al.*, 1956; Dexeus, 1957; Bruniquel and Israël, 1958; Goldberg and Levy, 1958), but most authors have used either local perineal infiltration or pudendal block (Malmström, 1954; Sohie, 1957; Pigeaud, 1957), Goldberg and Levy (1958) have referred to the advantage of the avoidance of general anaesthesia which the instrument permits in cases of respiratory or cardiac disease. Eschbach and Gandar (1957) observe that it is not only less dangerous but also less painful than forceps.

Effects on the Mother

There is widespread unanimity about the extreme safety of the method for the mother. As there is no instrumentation high in the birth canal, the risks of introduction of sepsis are minimized (Sterckx, 1957). No part of the instrument encroaches on the narrow diameters of the birth canal, and so all the available space in the pelvis remains for the passage of the foetus. Excessive or ill-directed efforts will result in detachment of the ventouse, and consequently damage to the birth canal is avoided (Goldberg and Levy, 1958). Laceration of the perineum is minimal and episiotomy can be undertaken if required. Though Voegeli (1958) described a third-degree tear in his series he attributed this to the use of undue force. No bladder complications have been recorded in the literature, though in one of our cases early urinary retention occurred, with slight haematuria for one day after an easy assisted delivery.

Effects on the Foetus

The presence of a large artificial caput is inevitable in the very nature of the method, and at first this presents a formidable swelling aptly described by Rosa (1955) as a "chignon." It rapidly diminishes in size and has almost completely abated in a few hours (Fauvet and Scheele, 1956), when it is usually no more obvious than a normal caput succedaneum (Fig. 2). Small ecchymoses or tiny ulcers around the perimeter of the cup may persist for a day or two, but these usually heal without causing any trouble. Slight scalp necrosis which cleared up satisfactorily was described after prolonged weight traction in one of Malmström's (1954) cases, and, in Vienna, Antoine (1959) abandoned this particular use of the instrument because of this complication. Roloff (1959) states that the instrument should not remain *in situ* for longer than 40 minutes in view of the risks of necrosis of the scalp. Goldberg and Levy (1958) state that the only possible foetal complication is the formation of a cephalhaematoma, which was avoided in their

series of 70 cases by the administration of vitamin K_1 and the application of a pressure-dressing on the foetal scalp. Muller (1959) states that even these measures are now regarded as unnecessary. Blackman *et al.* (1956) found cephalhaematoma in 10% of their cases but stated that there was no permanent scalp damage.

The only authors reporting a high incidence of injury are Meinrenken and Schieferstein (1957) with 29.6% and Chang (1958), using a Finderle instrument, with 31%, none of which in either series was serious. Pigeaud (1957) stated that in 200 cases mother and child escaped

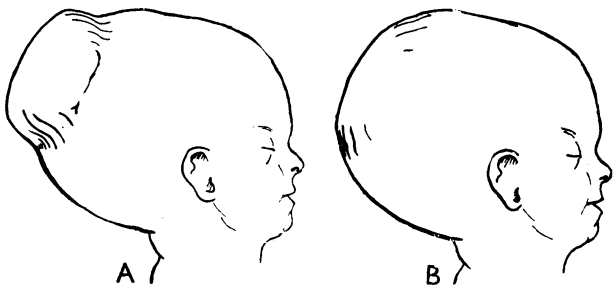

FIG. 2.—Head of child (A) immediately after delivery showing "chignon," and (B) 10 minutes later, when appearance is similar to normal caput succedaneum.

injury when the pressure was limited to 0.7 kg./cm². The great majority of authors are agreed on the lack of trauma to the foetus (Koller, 1950; Malmström, 1954; Finderle, 1955; Fauvet and Scheele, 1956; Blackman *et al.*, 1956; Sohie, 1957; Sterckx, 1957; Dexeus, 1957; Bruniquel and Israël, 1958; Goldberg and Levy, 1958; Berggren, 1958), and Rosa (1955) has calculated mathematically that compression of the foetal head by this method is less than one-twentieth of that applied in forceps deliveries.

Personal Experience

We first became interested in this instrument when one of us (J. A. C.) visited Snoeck's clinic in Brussels in 1957 and found that forceps had been displaced completely for a period of three years. Snoeck was extremely enthusiastic about the advantages of the instrument, and it was decided to try it here. In the 14 months since May, 1958, the ventouse has been employed in 100 women—79 were primigravidae, and 13 had had one, 6 had had two, and 2 had had three previous children.

During the 12 months up to April, 1958, forceps were applied in 10.3% of 936 deliveries. During the next 12 months the forceps rate fell to 4.1% and the vacuum extractor was used in 6.6% of 1,035 deliveries. In 88 cases delivery was successfully completed with the ventouse alone. In 12 instances, when an extraction had been started with the ventouse, forceps were employed to complete the operation. In eight of these (the cervix was incompletely dilated in four) dilatation of the cervix and rotation and descent of the head were obtained with the aid of the ventouse before the application of forceps, as described by Malmström (1954). In a few cases with acute foetal distress, if the ventouse was not immediately effective, forceps were used so as to secure delivery more rapidly. Three of the comparative failures of the ventouse were early cases, and we believe that inexperience of the new method contributed to the need to use forceps to complete delivery. The other cause of failure of the method was relative disproportion, where the powerful traction necessary to secure delivery could be applied with forceps but led inevitably to detachment of the ventouse.

All the children, whose weight ranged from 4 lb. 8 oz. to 11 lb. 2 oz. (2,040 to 5,045 g.) were born alive, with the exception of two in whom intrauterine death had preceded delivery by four hours and five days respectively. There were two neonatal deaths, in one of which forceps delivery was undertaken for acute foetal distress in a case in which difficulty had been experienced in obtaining adhesion with the ventouse. The second was a first twin weighing 4 lb. 8 oz. (2,040 g.) who died from tentorial tears six hours after an easy delivery. All the remaining infants made good progress and left hospital in good condition. In all cases the "chignon" resolved rapidly and had abated materially within six hours of delivery. In two cases small abrasions around the periphery of the caput persisted for about a week, but these healed without complication. No pressure-dressing or other similar treatment of the scalp has been found necessary.

Adhesion of the instrument was satisfactory in all but 10 cases. In seven of these completion of the delivery was undertaken with forceps as described above; in the other three repeated reapplication of the instrument enabled delivery to be completed. Most patients were delivered in the lithotomy position, but in four the dorsal and in two the left lateral position was used. Each was quite satisfactory. The longest time spent over delivery was 60 minutes and the shortest 7 minutes, the average being about 20 minutes.

In 84 cases the cervix was fully dilated, but in 16, including 13 primigravidae, dilatation was incomplete. In the latter group the indications for interference were: long labour with inertia in nine, foetal distress in six, and uterine scar in one.

In Case 87, a gravida-4, foetal distress occurred when the cervix was sacral, not completely effaced, and dilated only two fingerbreadths. Ventouse extraction under general anaesthesia, with incision of the cervix, secured in 45 minutes delivery of a child in satisfactory condition, successively larger cups being applied. The delivery was complicated by a post-partum haemorrhage from the incised cervix, but this was controlled by suture and there were no other complications.

General anaesthesia was used in 10 cases, in five of which forceps application was necessary after failure to complete extraction with the ventouse. In two cases breech extraction was undertaken, and in another extremely exhausted patient it was felt that local anaesthesia would impose an undue strain. The ninth patient, an Italian girl with little knowledge of English, was wildly excited and unmanageable with local anaesthesia. The last case in which general anaesthesia was necessary was Case 87, described above. Pudendal-block anaesthesia was employed in 50 patients and infiltration of the perineum in 36. In four cases no anaesthesia was used. Episiotomy was carried out in all but eight cases. In many cases gas-and-air or "trilene" analgesia was used. The employment of the ventouse did not in any instance increase maternal distress, and in those cases where local, regional, or no anaesthesia was used no discomfort was occasioned to the mother which caused difficulty in either the application or the subsequent extraction.

There were six twin pregnancies, in four of which both twins were extracted with the aid of the ventouse.

In the fifth the second twin, presenting by the breech, was delivered manually, and in the sixth the first twin was delivered with the aid of the ventouse applied to the breech, and the second by application to the vertex, the head being above the pelvic brim.

In 100 instances the vertex presented, the occiput being anterior in 57, lateral in 26, and posterior in 17 when delivery was begun. In the posterior positions face-to-pubis delivery occurred in 10 and "auto-rotation" (Evelbauer, 1956) in 7. In the 26 lateral positions of the occiput rotation occurred in 24; one child, weighing 5 lb. 9 oz. (2,525 g.), emerged with the occiput more or less lateral, and in another Kielland's forceps rotation proved to be necessary. Two brow presentations were encountered. One was a second twin weighing 5 lb. 6 oz. (2,440 g.) who was delivered as a brow from a large pelvis. The second brow presentation was flexed automatically by means of the posterior cephalic application of the instrument, and was delivered as an occipito-posterior, auto-rotation through 140 degrees having occurred. Three cases presented as frank breeches with delay in the second stage. Application of the ventouse to the anterior buttock secured descent from high to low pelvis, so that an easy extraction could be carried out. Kaeser (personal communication, 1958) and Bruniquel and Israël (1958) report a similar use of the ventouse in breech delivery.

The accompanying Table shows the principal indication for intervention in each case. Uterine intertia was the predominant factor in cases with a long first stage, the longest of which lasted 51 hours. In five of these cases intervention was undertaken as soon as possible in the second stage, but in nine the ventouse was applied before the cervix was fully dilated.

Indications for Intervention

Indications	Primi-gravidae	Multi-parae	Total
Long or complicated first stage	12	2	14
Foetal distress	16	7	23
Unprogressive or prolonged second stage	34	10	44
Other maternal factors*	17	2	19
	79	21	100

* Severe toxaemia in 10, cardiac disease in 3, hysteria in 3, uterine scar after extensive myomectomy in 1, diminished respiratory reserve after lobectomy in 1, and laparotomy for acute appendicitis six hours before delivery in one.

Foetal distress was the leading indication in 23 cases, in six of which the cervix was incompletely dilated. Both neonatal deaths were included in this group. Prolongation of the second stage occurred in 44 cases. In most of these the cervix had been fully dilated for more than two hours; in the others there was obvious failure to progress or some additional feature was present.

Discussion

Our first introduction to this instrument came from a French-speaking source, and for this reason and for brevity we have used the term "ventouse" in our text and in our work rather than "vacuum extractor," the name employed by Malmström. Our personal experience and our study of the literature have indicated certain advantages of this instrument as compared with forceps. The method is of extreme simplicity, and in this unit has become popular with the medical and nursing staff, and even house-surgeons quite new to operative obstetrics have had no difficulty in picking up the technique. The only notable feature of the technique requiring discussion is the occasional difficulty in securing adhesion. Our own experience is that failure of adhesion has become rare when attention has been paid to the following points. Firstly, plenty of time must be allowed for the reduction of pressure, and this must be done by stages over a period of 6 to 10 minutes. Secondly, traction must be perpendicular to the transverse axis of the cup. When the foetal head lies at a relatively high level in the pelvis the cup of the ventouse must be placed on the most posterior part of the head that can be reached in order to achieve this perpendicular traction. This means that it is not always advantageous to place the cup on a preformed caput (cf. Malmström, 1957a).

We cannot confirm the view of Charrier and Docquier (1957) and Cunningham (1958) that failure of the method may be due to omission to rotate the head before application of the ventouse. In our series we have found that the ventouse can promote flexion of the head and can achieve rotation by means of those natural forces promoting rotation which forceps tend to inhibit. These features make the instrument particularly useful in cases of malpresentation and malposition such as deep transverse arrest. This use of the ventouse offers several advantages over either manual or forceps rotation, particularly in reducing the need for general anaesthesia and also in avoiding the necessity of displacing the head upwards in the pelvis.

We have used the ventouse to replace forceps and not, as has Pigeaud (1957), to shorten labour in normal primigravidae. Rosa (1955), Sterckx (1957), and Goldberg and Levy (1958) all refer to their readiness to apply it in the same way as "forceps de complaisance" because of its great safety.

One of the great advantages of this instrument over forceps is that it can be applied in the first stage of labour to promote dilatation of the cervix. This is achieved in a physiological manner by augmenting uterine contractions as well as by drawing the presenting part down the birth canal, usually without tearing or incision. The smallest cup can be applied at about half dilatation of the cervix, but as dilatation proceeds a larger cup may be substituted and more powerful traction employed.

Traction may be either continuous by means of a weight as described by Koller (1950) and Malmström (1954) or by hand simultaneous with uterine contractions. In the latter method, which we have used exclusively, the active co-operation of the mother is an important advantage (Blackman *et al.*, 1956). The instrument has been applied to the head at all levels in the pelvis, though Bourg (1957) and Sohie (1957) both regard non-engagement of the head as a contra-indication. In our own series, in two second twins the head was at the pelvic brim at the time of application and no difficulty with the deliveries was experienced. Sohie (1957) also refers to this use of the ventouse to avoid internal version and breech extraction for delayed second twins. In all our remaining cases the presenting part was in the pelvic cavity. Cephalopelvic disproportion is usually regarded as a contraindication to the use of the ventouse (Finderle, 1955; Aschan and Saloheimo, 1955; Blackman *et al.*, 1956), and we have found that forceps delivery is required when more than a minor degree of disproportion is present. Bruniquel and Israël (1958), however, have advocated its use as a "trial tractor" in cases of possible disproportion in much the same way as the "trial forceps" of Jeffcoate (1953),

and Muller (1959) stresses the greater safety of the ventouse as compared with the forceps in this connexion.

In this unit we have used the instrument to terminate labour for delay in the second stage, for maternal and foetal distress, and in a variety of special cases. Special indications referred to in the literature, apart from those that we have encountered in our own series, include eclampsia and "shock" (Finderle, 1952), epilepsy (Goldberg and Levy, 1958), weakness of the abdominal wall (Bruniquel and Israël, 1958), marginal placenta praevia (Sterckx, 1957; Meinrenken and Schieferstein, 1957), premature separation of the placenta (Finderle, 1955), prolapse of the cord (Meinrenken and Schieferstein, 1957), and rigidity of soft tissues (Maire, (1957).

With regard to the use of the instrument for premature births, we have delivered nine babies weighing less than 5 lb. 8 oz. (2,485 g.) and in eight of these have been satisfied that the ventouse did not cause injury. All these babies made good progress after delivery, with the exception of Case 30, in which the child, weighing 4 lb. 8 oz. (2,040 g.), died from tentorial tears. This damage may have been caused by the instrument, but a similar risk of intracranial haemorrhage is, of course, present in forceps delivery or even in spontaneous delivery in children of this size. Both deWatteville (1958) and Voegeli (1958) have reservations regarding the use of the ventouse for delivery of premature babies. The latter refers to the ability of the forceps blades to protect the premature head from soft-tissue damage, though Rosa (1955) regards this as completely illusory. We cannot, therefore, at this stage say for certain whether ventouse extraction of the smallest premature babies is to be recommended.

In breech deliveries, when progress has ceased with the buttocks low in the pelvis, application of the ventouse may avoid the necessity to bring down a leg under a general anaesthetic.

There are certain instances where the ventouse cannot replace forceps; these include face presentation, the aftercoming head, and transverse lie. After manipulation of an oblique or transverse lie to a cephalic presentation there might, however, be a useful place for the application of the ventouse.

It is sometimes possible to complete a delivery very rapidly with the ventouse, but when there is acute foetal distress a forceps delivery, which is usually quicker, is the treatment we have generally employed, as advocated by deWatteville (1958) and Muller (1959). Where foetal distress is less urgent we have had satisfactory results with the ventouse, and, indeed, Malmström (1957b) claims that weak foetal heart sounds may be favourably influenced by the application of traction.

We have also felt it necessary to retain forceps delivery for the training of house-surgeons, since the ventouse is not yet, so far as we know, in use in this country in general practice. Two of our house-surgeons who have used the ventouse have, however, expressed their intention of employing the instrument in general practice, and we feel that, subject to such limitations as are recognized for the use of forceps in domiciliary obstetrics, there may well be a place for the ventouse in the patient's home.

One of the greatest recommendations for the use of the ventouse for assisted deliveries is its simplicity. However, despite the simplicity of the method it is of primary importance, as in all obstetric operations, that a careful assessment of the case, including an exact vaginal examination, should precede any operative intervention. In particular, the position of the head in the pelvis should be accurately determined, especially so that the optimal point of application of the ventouse may be selected.

Conclusions

Our experience with this new method has confirmed Snoeck's view that it is a valuable addition to the obstetricians' armamentarium. It can replace the use of forceps in a wide range of conditions. It has the advantage over forceps that it can be used to deal with the problem of delay in the first stage of labour. In some instances, however, the time required for delivery with the ventouse is a disadvantage, and for this reason we regard it as unsuitable in acute foetal distress. In premature labour, in our experience so far, the instrument has probably been as safe as forceps, though deWatteville (1958) suggests that it should not be used with premature babies.

Finally, though we are not prepared to follow the example of Pigeaud (1957) in using the instrument routinely in all normal deliveries, we agree with Rosa (1955), Sohie (1957), and others that the ease and safety of application are strong recommendations for using it freely.

Summary

The use of the vacuum extractor (ventouse) in obstetrics is described and the literature surveyed.

Our experience of 100 cases delivered by means of the Malmström instrument is recorded.

It is considered that the instrument is safe for mother and child and can effectively replace the obstetric forceps in most instances except where there is acute foetal distress or a material degree of cephalopelvic disproportion.

In addition, it can be used during the first stage of labour to augment pains and promote dilatation of the cervix so that early delivery becomes possible.

Rotation of the occipito-posterior or transversely arrested head can in most instances be more easily and more physiologically effected with the ventouse than either manually or with forceps.

We are indebted to our colleague Mr. A. T. Marshall for help and criticism of this paper and for permitting us to quote results in several of his cases in the above series. We are grateful to Mrs. Joan Knowles for Fig. 2.

REFERENCES

Antoine, T. (1959). Personal communication.
Aschan, E., and Saloheimo, A. (1955). *Nord. Med.*, **54**, 1698.
Berggren, O. G. A. (1958). *Svenska. Läk.-Tidn.*, **55**, 3715.
Blackman, J. H., Pierret, R., and Dussart, R. (1956). *Scalpel (Brux)*, **109**, 393
Bourg, R. (1957). *Ann. Soc. belge Méd. trop.*, **37**, 573.
Bruniquel, G., and Israël, A. (1958). *Gynéc. et Obstét.*, **57**, 222
Chang, Y. H. (1958) *Chin. J. Obstet. Gynec.*, **6**, 430.
Charrier, J., and Docquier, J. (1957). *Bull. Féd. Gynéc. Obstét. franç.*, **9**, 63.
Couzigou, Y. (1947). Prospectus.
Cunningham, W. D (1958). *Med. J. Aust.*, **1**, 595.
deWatteville, H. (1958). 2nd World Congr. Obstet. Gynaec., Montreal, 1958
Dexeus, J. M (1957). *Obstet. Ginec. lat.-amer.*, **15**, 253.
Eschbach, J., and Gandar, R. (1957). *Bull. Féd. Gynec. Obstét. franç.*, **9**, 448.
Evelbauer, K (1956). *Geburtsh. u. Frauenheilk.*, **16**, 223.
Fauvet, E., and Scheele, R. (1956). Ibid., **16**, 231.
Finderle, V. (1952). *Gynaecologia (Basel)*, **133**, 225.
—— (1955). *Amer. J. Obstet. Gynec.*, **69**, 1148.
Gastaldo, E. (1951). *Minerva ginec. (Torino)*, Suppl., **3**, 547.
Goldberg, G., and Levy, G. (1958). Strasbourg Obstet. Gynaec. Soc.

Jeffcoate, T. N. A. (1953). *Brit. med. J.*, **2**, 951.
Koller, O. (1950). *Acta obstet. gynec. scand.*, **30**, Suppl. 7, p. 145.
Lobban, M. (1955). *Nurs. Mirror*, **101**, May 20, p. xi.
Maire, M. (1957). *Bull. Féd. Gynéc. Obstét. franç.*, **9**, 62.
Malmström, T. (1954). *Acta obstet. gynec. scand.*, **33**, Suppl. 4.
—— (1957a). Ibid, **36**, Suppl. 3.
—— (1957b). *Midwives Chron.*, **70**, 184.
Meinrenken, H., and Schieferstein, W. (1957). *Geburtsh. u. Frauenheilk.*, **17**, 1086.
Muller, P. (1958). 2nd World Congr. Obstet. Gynaec., Montreal, 1953.
—— (1959). *Rev. Méd. prat.*, 40.
Petchenko, A. I. (1958). *Sovetsk. Med.*, No. 3, p. 69.
Pigeaud, H. (1957). *Gynéc. et Obstét.*, **56**, 166.
Roloff, H. E. (1959). *Geburtsh. u. Frauenheilk.*, **19**, 274.
Rosa, P. (1955). *Bull. Soc. roy. belge Gynéc. Obstét.*, **25**, 142.
—— and Piraux, P. (1957). *Bull. Féd. Gynéc. Obstét. franç.*, **9**, 1.
Sohie, T. (1957). *Ann. Soc. belge Méd. trop.*, **37**, 679.
Sterckx, P. (1957). Ibid., **37**, 689.
Torpin, R. (1938). *J. med. Ass., Ga.*, **27**, 96.
Voegeli, H. (1958). *Gynéc. et. Obstét.*, **57**, 95.

PERSISTENCE OF ANTIBODY IN ADOLESCENTS AND ADULTS AFTER A THIRD, BOOSTER, DOSE OF POLIOMYELITIS VACCINE

BY

E. J. C. KENDALL, M.B., M.R.C.P.
Medical Officer, Epsom College

T. S. L. BESWICK, M.D., M.R.C.P.

ANN MILLER, B.Sc.

AND

J. O'H. TOBIN, B.M., B.Ch.
Biological Standards Control Laboratory, Medical Research Council Laboratories, London, N.W.3

In previous reports (Reports, 1958, 1959) results were given of the neutralizing antibody responses obtained in a group of public-school boys and medical personnel after immunization with inactivated poliomyelitis vaccine. The subjects, none of whom had detectable antibodies to any of the three types of poliovirus before immunization, were given two injections of vaccine four weeks apart and a third, booster, injection 6 to 12 months later; serum samples were taken two weeks after the third dose. Further tests have now been made with the same group to determine the persistence of antibody after periods of up to two years.

Methods

Samples of serum were obtained from 46 of the schoolboys and from eight of the medical personnel at 18, 21, or 24 months after the third dose. They were titrated for neutralizing antibody in parallel with the serum samples taken two weeks after the third dose, all sera being tested against each virus type at one time. The galactose colour test was employed (Perkins and Evans, 1959), using fourfold serum dilutions in 0.25-ml. amounts, mixed with 100 $TCID_{50}$ of virus in 0.25 ml. All dilutions were made in Hanks solution and two cell-culture tubes were used for each serum dilution. Titres are expressed as the reciprocal of the initial dilution of serum protecting 50% of the tubes from virus action.

A fourth dose of 2 ml. of vaccine was given to those subjects whose antibody to type 1 had fallen to an undetectable level. The antibody responses to this dose were determined two weeks later.

At the time of taking the serum samples, saliva was obtained from some of the boys. After incubation at 56° C. for 30 minutes, 0.25 ml. of the twofold and eightfold dilutions were mixed with 10–30 $TCID_{50}$ of virus and, after 3½ hours' incubation at 37° C., added to prepared monkey-kidney-cell cultures, two tubes being used for each salivary dilution. Microscopical readings were taken after four days' incubation, as by this time the tubes had become acid.

Results

Figs. 1, 2, and 3 show the decline in serum antibody to each of the three types after the third dose of vaccine. After 18 to 24 months all 54 subjects had detectable

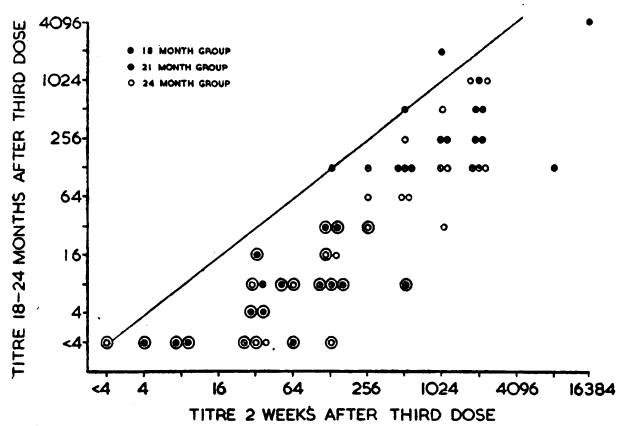

FIG. 1.—Decline in type 1 antibody titre after a third dose of poliomyelitis vaccine.

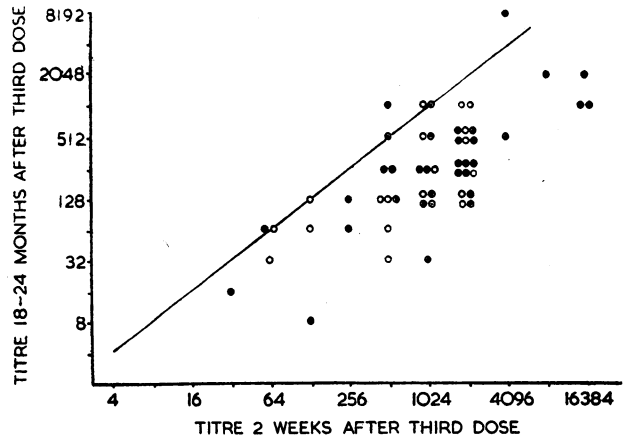

FIG. 2.—Decline in type 2 antibody titre after a third dose of poliomyelitis vaccine.

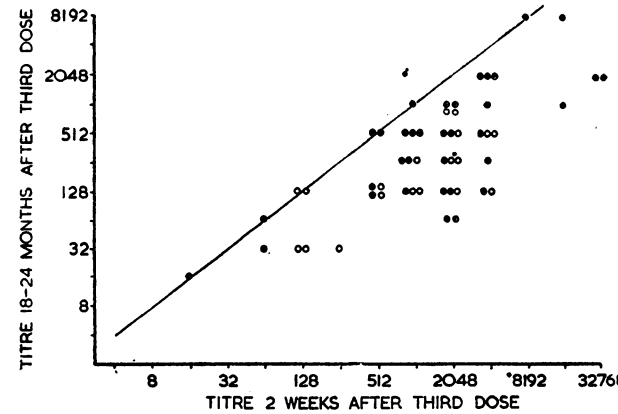

FIG. 3.—Decline in type 3 antibody titre after a third dose of poliomyelitis vaccine.