TABLE II.—*Effect on Thromboplastin Generation Test of Adding Various Sera to the Patient's Serum*

Serum Incubated with $Al(OH)_3$-plasma, Platelets, and 0·025 M $CaCl_2$	Substrate Clotting-Time‡ (sec.)
Normal serum	10
Patient's ,,	25
Serum of patient receiving ethyl biscoumacetate	43
,, ,, ,, phenindione	29½
Christmas disease serum	38
Patient's serum mixed with 10% of:	
Normal serum	16
Serum of patient receiving ethyl biscoumacetate*	27
,, ,, ,, phenindione†	25
Christmas disease serum	18
Congenital factor-VII-deficient serum§	16½

* One-stage prothrombin time 42 seconds (normal 12 seconds).
† One-stage prothrombin time 29 seconds (normal 11 seconds).
‡ The activity of thromboplastin produced in each mixture was tested after six minutes by taking 0·1 ml. thereof together with 0·1 ml. of 0·025 M $CaCl_2$ and adding them simultaneously to 0·1 ml. of normal citrated plasma (substrate) at 37° C., recording the clotting-time.
§ This gave normal results (10 seconds) when tested by the thromboplastin generation method.

ethyl biscoumacetate or phenindione were ineffective in correcting the clotting defect (Tables I and II). Similarly, the coumarin-induced defect was not corrected by the patient's plasma or serum.

Liver-function Tests.—Paper electrophoresis of serum, using barbitone buffer *p*H 8.6, showed normal bands. Serum thymol turbidity was 0.2 unit and serum alkaline phosphatase 22 units.

Effects of Vitamin K.—The blood-clotting tests were repeated before and during a course of vitamin K, 40 mg. daily for four weeks. The blood-clotting defect was not affected by this treatment. Furthermore, the clinical picture was not improved, the patient having an episode of epistaxis while receiving the drug.

Examination of Father's Blood.—This was found to be normal.

Discussion

The condition described in this paper seems to be a congenital anomaly; the haemorrhagic tendency appeared before the age of 6 in the patient, who received no coumarin drugs. The results of the blood-clotting tests are similar to those found in patients receiving these drugs. Thus the patient has normal blood and plasma clotting-times but a prolonged one-stage prothrombin time, and his serum is lacking in factor(s) necessary for the generation of normal levels of plasma thromboplastin (Biggs *et al.*, 1953). Furthermore, the two-stage method shows that the concentration of prothrombin is below normal levels and demonstrates a retardation in the conversion of this factor to thrombin. Unlike the coumarin defect, however, the patient's deficiency was not influenced by vitamin K therapy.

Walker and Hunter (1954) provided evidence which suggested that the action of coumarin drugs on the blood-clotting mechanism is not restricted to prothrombin and factor VII only; another factor, termed factor X, was, in addition, thought to be involved. This view has been followed by various reports which seem to indicate that these drugs produce multiple defects (Koller, 1955; Biggs, 1956; Greig and Tattersall, 1956), the exact nature of which is still far from being solved. Whatever the final outcome of further investigations in this respect, however, it is apparent that the blood-clotting factors affected by these drugs are also lacking in the blood of our patient, as can be deduced from the failure of mutual correction.

Several workers have described cases in which plasma gave an abnormal one-stage prothrombin time. Some of these were presumed to be due to a deficiency of factor VII and have been reviewed by Ackroyd (1956). Patients diagnosed as having hypoprothrombinaemia have been mentioned by Biggs and Macfarlane (1957). Of the recorded cases, only those described by Newcomb *et al.* (1956) and Biggs (1956) seem to bear some resemblance to our patient.

Summary

The clinical features of a patient with a mild haemorrhagic diathesis are reported. Laboratory investigations demonstrated that, although the congenital blood-clotting defect is basically similar to that produced by coumarin drugs, no improvement was achieved by vitamin K therapy.

We thank the Department of Medical Illustration, Manchester Royal Infirmary, for help in preparing the Chart.

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EFFECT OF CASTOR OIL, SOAP ENEMA, AND HOT BATH ON THE PREGNANT HUMAN UTERUS NEAR TERM

A TOCOGRAPHIC STUDY

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The administration of castor oil, followed by a soap enema and a hot bath, is probably one of the oldest and most frequently attempted methods of inducing labour. This regime is also used as a complement to other induction procedures, such as an oxytocin ("pitocin") drip or surgical rupture of the membranes.

Recently, however, some obstetricians have tended to regard castor oil as an ineffective oxytocic drug and have abandoned its use altogether in the induction of labour. Nabors (1958) carried out a clinical trial of the effectiveness of "rupture of membranes and pitocin" either alone or combined with castor oil or enema, or castor oil and enema together. On the basis of his findings he concluded that castor oil is of no value in the induction of labour. However, a study of his figures shows that there were fewer "failed inductions" in the group which was given castor oil.

Castor oil has so many unpleasant features, such as its taste and its tendency to produce nausea, vomiting,

and diarrhoea, that its continued use is justified only if it is a reasonably effective oxytocic.

It was for this reason that we decided to assess, with the aid of a tocograph, the possible effects of castor oil, a soap enema, and a hot bath upon uterine contractility in late pregnancy.

Material and Methods

Sixty subjects, all between 38 and 41 weeks pregnant, were selected for the investigation and divided into four groups of 15. Cases of cephalo-pelvic disproportion, malpresentation, ante-partum haemorrhage, hydramnios, and those showing any sign of the onset of labour were excluded.

Castor oil, a soap enema, and a hot bath (a "complete O.B.E.") were administered to each subject in the first group; only castor oil was given to those in the second, only a soap enema to those in the third, and only a hot bath to those in the fourth group. The changes in uterine activity in each case were assessed by the use of the guard-ring tocodynamometer described by Smyth (1957). Smyth claims that this instrument can provide an absolute measurement of the changes in intra-amniotic pressure, and thus of the uterine contractions.

In conformity with Smyth's recommendations the head of the instrument was applied to the anterior abdominal wall over a fluid-filled part of the uterus and held in place by a stiff elastic belt passed around the subject.

With the head of the instrument in the same position on the abdominal wall and the elastic belt at the same tension, a recording was taken in each case before and after the four different methods adopted. Each tracing was recorded for at least one hour on a chart moving at a constant speed of 12 in. (30.5 cm.) an hour.

In order to assess accurately the extent of change in the uterine contractions the instrument was also calibrated according to the directions of Smyth (1957).

Method of Assessing Effect of Complete O.B.E.—In this group the first recordings were taken within 12 hours before the administration of the O.B.E. Castor oil, 2½ oz. (71 ml.), was given by mouth, and after two bowel actions, usually within three hours, this was followed by a soap enema (2 oz. (57 ml.) of enema soap in 2 pints (1,140 ml.) of water at blood heat). The enema was allowed to act and the subjects were then given a hot bath. This completed, they were returned to bed and the second tracing was started.

Method of Assessing Effect of Castor Oil.—Castor oil, 2½ oz. (71 ml.), was administered by mouth to the 15 subjects in this group at the completion of the first recording. The second recording was started after at least two bowel actions, again usually within three hours of the administration of the castor oil.

Method of Assessing Effect of Soap Enema.—In this group a soap enema was administered at the completion of the first recording and the second tracing started after the enema had acted.

Method of Assessing Effect of Hot Bath.—The tracings were taken in this group just before and immediately after the subjects had been given a hot bath.

Interpretation of Tracings

From a careful study of the two tracings from each subject, the work done by the uterus in contracting before and after the administration was compared.

From the two tracings obtained in each subject the amplitude in grammes per square centimetre and the duration of each contraction in minutes and their frequency were calculated.

According to Reynolds *et al.* (1954) the sum of the areas of all contractions in a given time unit is an index of the contractile work of the uterus in that time. With his indirect method the product of the duration and the amplitude of each contraction and the number of contractions per hour yielded an index of the total contractile work done by the uterus in that hour.

To exclude the minor variations in uterine tone (Alverez and Caldeyro Barcia, 1953) amplitudes of less than 10 g. per sq. cm. were excluded from the assessment.

In each case the index of contractile work done by the uterus per hour before and after the treatment was determined and the percentage difference calculated.

Control Group.—Study of tracings of uterine contractions recorded for one hour often shows some minor spontaneous variation in activity during this time. This constitutes a possible source of error when comparing tracings from the same individual taken several hours apart. In order to assess the accuracy of the results a control group of 15 other subjects, comparable in every way to those in the other four groups, were chosen. In each of these the two tracings were taken three hours apart, with the head of the

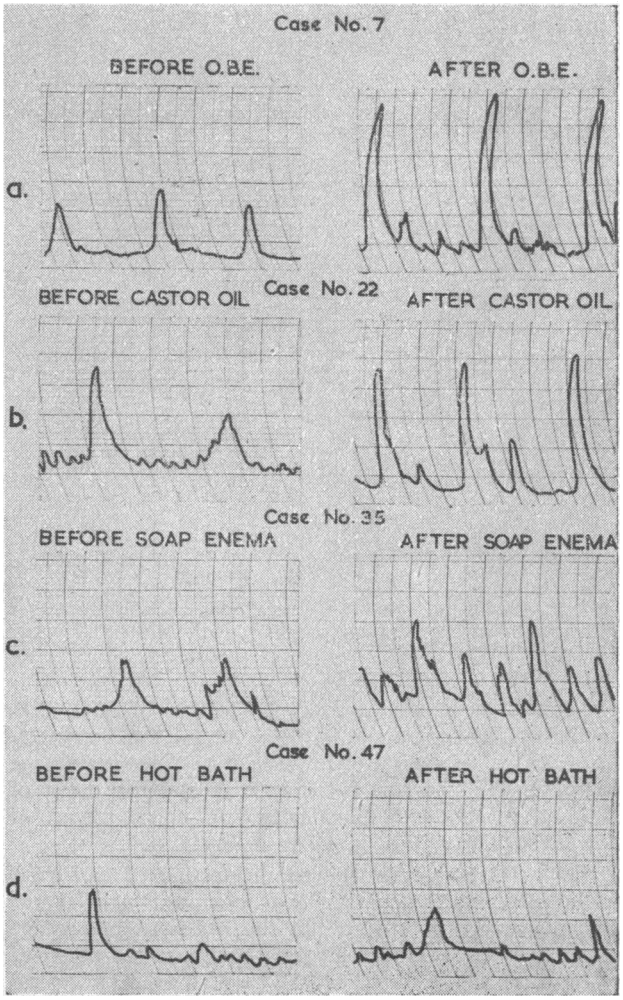

FIG. 1.—Sections of typical tracings.

instrument in the same position and the elastic belt at the same tension but with no treatment in the interval.

Results

The results are shown in Tables I–V.

TABLE I.—*Effect of Complete O.B.E.*

Case No.	Gravidity	Index of Contractile Work of Uterus		
		Before O.B.E.	After O.B.E.	Increase after O.B.E.
1	M	195·75	897·75	+359%
2	M	260·0	1,199·5	+361%
3	P	312·5	1,139·25	+265%
4	P	552·75	1,062·75	+92%
5	M	83·75	253·5	+203%
6	P	109·75	581·0	+429%
7	P	218·0	705·75	+224%
8	M	360·0	1,082·75	+201%
9	M	202·25	269·0	+33%
10	P	92·5	223·5	+142%
11	M	241·75	308·5	+28%
12	P	76·25	711·0	+833%
13	P	234·25	1,021·75	+336%
14	P	87·75	203·5	+132%
15	M	223·25	946·5	+324%
Mean increase after O.B.E.				264%

TABLE II.—*Effect of Castor Oil*

Case No.	Gravidity	Index of Contractile Work of Uterus		
		Before Castor Oil	After Castor Oil	Increase after Oil
16	P	603·0	1,070·0	+78%
17	M	70·0	212·75	+204%
18	M	550·5	1,120·5	+104%
19	M	404·5	631·5	+56%
20	M	183·0	730·25	+299%
21	P	1,242·25	1,060·75	−15%
22	P	656·5	1,661·0	+153%
23	P	409·0	1,122·25	+174%
24	P	555·25	690·5	+24%
25	M	426·5	2,134·75	+401%
26	P	514·75	471·5	−8%
27	M	58·5	644·0	+1,001%
28	P	120·0	269·5	+125%
29	M	441·25	825·0	+87%
30	P	487·5	1,028·75	+111%
Mean increase after oil				186%

TABLE III.—*Effect of Enema*

Case No.	Gravidity	Index of Contractile Work of Uterus		
		Before Soap Enema	After Soap Enema	Increase after Soap Enema
31	M	139·25	258·0	+85%
32	M	327·5	526·0	+60%
33	P	1,324·0	1,054·75	−20%
34	M	148·25	269·75	+82%
35	P	252·5	522·0	+107%
36	P	112·5	159·5	+42%
37	M	243·5	521·5	+114%
38	P	476·0	438·0	−8%
39	M	180·0	228·25	+27%
40	P	41·25	245·5	+495%
41	P	122·75	215·0	+75%
42	M	764·25	871·5	+14%
43	P	277·0	446·75	+61%
44	M	199·25	571·25	+187%
45	M	364·25	761·0	+109%
Mean % increase after soap enema				95%

Table I shows that the administration of an O.B.E. increases the contractile work done by the uterus by an average of 264%. In this series of percentage increases the standard error is 51.6, and the mean of +264% is significant ($P<0.001$). A typical tracing of the effect of an O.B.E. is shown in Fig. 1, a.

Table II shows that the administration of castor oil alone increases the contractile work done by the uterus by an average of 186%. In this series of percentage differences the standard error is 64.9, and the mean of +186% is significant ($P<0.02$ but >0.01). A typical tracing of the effect of castor oil is shown in Fig. 1, b.

Table III shows that the administration of a soap enema alone increases the contractile work done by the uterus by an average of 95%. In this series of percentage differences the standard error is 31.6, and the mean of +95% is significant ($P<0.01$ but >0.001). A typical tracing of the effect of a soap enema is shown in Fig. 1, c.

Table IV shows that the administration of a hot bath alone has little effect on the contractile work done by the uterus. In this series of percentage differences the standard error is 3.6, and the mean of +6% is not statistically significant. A typical tracing of the effect of a hot bath is shown in Fig. 1, d.

TABLE IV.—*Effect of Hot Bath*

Case No.	Gravidity	Index of Contractile Work of Uterus		
		Before Hot Bath	After Hot Bath	Increase after Hot Bath
46	P	27·5	28·0	+2%
47	P	154·5	139·0	−10%
48	P	82·5	110·0	+33%
49	P	96·0	94·0	−2%
50	P	0·0	0·0	0%
51	P	345·75	431·5	+25%
52	M	293·5	302·5	+3%
53	P	193·0	173·0	−10%
54	M	312·75	284·5	−9%
55	M	272·5	313·25	+15%
56	M	194·25	198·25	+2%
57	M	89·0	95·25	+7%
58	M	227·5	273·0	+20%
59	M	132·75	146·0	+10%
60	M	169·0	163·75	−3%
Mean increase after hot bath				6%

TABLE V.—*Control Group*

Case No.	Gravidity	Index of Contractile Work of Uterus		
		First Tracing	Second Tracing	Percentage Difference
61	P	288·75	268·5	−7%
62	P	1,057·75	1,166·0	+10%
63	M	126·0	103·5	−18%
64	P	547·5	481·5	−12%
65	M	337·5	273·5	−19%
66	P	75·0	91·5	+22%
67	P	145·0	153·5	+6%
68	M	241·25	231·0	−4%
69	P	98·0	101·0	+3%
70	M	852·0	705·0	−17%
71	P	209·0	231·75	+11%
72	M	46·0	40·0	−13%
73	M	199·5	136·5	−32%
74	M	183·25	198·0	+8%
75	P	231·5	250·75	+8%
Mean difference				−4%

Table V shows that in the control group there is a spontaneous variation of uterine activity in these individual cases between −32% and +22% in the course of three hours. In this series of percentage differences the standard error is 3.8, and the mean of −4% is not statistically significant.

It can be concluded, therefore, that in the groups given an O.B.E., castor oil, a soap enema, or a hot bath any significant change in uterine activity can be attributed directly to the treatment.

Discussion

Consideration of the results described shows that the administration of castor oil, a soap enema, and a hot bath to a woman between 38 and 41 weeks pregnant causes a marked increase (264%) in the contractile work done by the uterus. The most effective component is castor oil (+186%). A soap enema produces a less marked but still considerable effect (+95%), while a hot bath produces no change of statistical significance (+6%). Castor oil and a soap enema, therefore, probably

act synergistically to produce the full effect of a complete O.B.E., the hot bath playing little or no part.

According to Reynolds *et al.* (1954) there is a direct relationship between the intensity of uterine activity in the later weeks of pregnancy and the time of onset of labour: the greater the uterine activity the earlier labour begins. Therefore, as the work done by the uterus is increased by the administration of an O.B.E., it seems highly probable that this procedure will often expedite the spontaneous onset of labour or, alternatively, increase the effectiveness of other methods of induction, such as artificial rupture of the membranes.

It is possible that another more palatable purgative could be proved to have the same oxytocic activity as castor oil.

Summary

The effect of castor oil, a soap enema, and a hot bath (a complete O.B.E.) and its individual components on the activity of the pregnant human uterus near term has been studied, using the guard-ring tocodynamometer.

The marked increase in uterine activity produced by an O.B.E. justifies its retention in obstetric practice as a method of induction of labour or as a prelude to other induction procedures.

A hot bath, while not contributing to this response, has other obvious effects which favour its continued use.

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A HAND-OPERATED RESUSCITATOR

BY

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In the first-aid treatment of respiratory failure from any cause, speed in applying artificial respiration is essential. Any form of ventilation, whether manual or otherwise, may be life-saving if it is applied at once, and there is a growing view that positive pressure, either in the form of mouth-to-mouth or by machine, is more effective. Possibly because of aesthetic considerations, the mouth-to-mouth method has never achieved the popularity it deserves, and, although many positive-pressure machines are now available, most of them can be operated only by trained medical personnel, and are complicated and cumbersome because they need oxygen cylinders.

The ideal machine should be simple, portable, and robust; cheap to manufacture so that it can be available in large numbers; and designed in such a way that it can be used by untrained personnel. A simple hand-operated resuscitator, which appears to meet all these requirements, has been developed by the Ministry of Supply.

It consists of three main components: (1) rubber facepiece, (2) exhalation valve unit, and (3) air supply unit (Fig. 1). All the metal parts are anodized aluminium, and all the rubber parts are of high quality, with a life of at least ten years. The components are connected together by simple screwed joints, so that they can be disconnected for cleaning. The whole apparatus can be sterilized by autoclaving or by boiling.

The Apparatus

Rubber Facepiece.—This consists of a rubber oro-nasal mask which has been specially designed for the resuscitator to meet the requirements of a close pressure-tight fit on as wide a range of faces as possible, coupled with support of the lower jaw. The fit on the face is achieved by a large anatomically shaped pneumatic cushion, which is formed integrally with the wall of the mask. This cushion is filled with air at atmospheric pressure, and can be opened and closed manually by means of a small knurled screw (not shown in Fig. 1), turning in a special metal pressure-release plug situated on the left cheek of the mask. This enables the air in the cushion to be maintained at atmospheric pressure, and provides a means of venting the cushion during sterilization of the facepiece. Attached to the front of the mask is a female screw adapter which is so positioned that when the facepiece is connected to the rest of the apparatus it is at the correct angle to thrust the patient's jaw upwards when the bellows are operated, thus ensuring a clear airway (Fig. 2).

Exhalation Valve Unit.—The valve is a slightly concave, moulded rubber diaphragm with a central circular orifice which is closed by a hinged rubber flap. In its resting position, the diaphragm is lightly pressed against a circular metal seating on the bellows side of the unit. When the bellows are compressed the diaphragm is raised off its original seating by the air pressure and seals against a larger circular seating on the facepiece side of the unit, and air passes through the central orifice into the facepiece. At the end of the compression stroke the valve returns to its resting position and the patient exhales freely to atmosphere through a gap around the periphery of the unit. The hinged flap over the central orifice in the diaphragm ensures that the air will not leak back past the diaphragm, and thus that no exhaled air can be drawn into the bellows. The flap is reinforced by a slightly larger disk of rubber riveted to it to prevent it from becoming inverted irreversibly. The diaphragm valve is contained in a flat circular metal housing, which has a male screw adapter at one side and a female screw adapter at the other, which prevents the unit from being assembled in the resuscitator the wrong way round.

If necessary, for civil defence purposes an anti-gas canister can be fitted between the facepiece and the exhalation valve unit.

Air Supply Unit.—The unit consists of a circular rubber bellows, with a male screw adapter at one end for connexion to the exhalation valve unit. At the outer end of the bellows, mounted on a metal plate, are