

MORPHOLOGICAL CHANGES IN THE FOETUS AFTER INTRA-AMNIOTIC SALINE ABORTION

by

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Use of hypertonic saline for induction of mid-trimester abortion is one of the most rapidly expanding subjects of interest today.

The basic pathological changes which occur in foetal-mother organisational set-up by introducing hypertonic solution of sodium chloride intra-amniotically can be traced back to the Glaud Bernards original conception of "Mileu interior" i.e. preservation of a normal concentration of compartments of the body fluid including electrolytes.

Galen, *et al* (1974) studied the morphological effects of hypertonic saline on the foetus to know the actual mechanism of foetal death. They studied 143 consecutive mid-trimester therapeutic abortions induced by saline. They observed widespread vascular dilatation, congestion, oedema, haemorrhage and parenchymatous dehydration as main histological findings. These lesions are comparable to those found in acute salt poisoning of infants, oral salt poisoning of animals and human, and animal hypernatraemia caused by other factors.

On the basis of evidence from this study and other studies, they concluded that the mechanism of foetal death was

primarily due to acute salt poisoning, and placental damage played a much less important role.

This study was taken up with a view to find out the pathological changes in the foetus after medical termination of pregnancy with hypertonic saline in different periods of gestation.

Material and Methods

A total number of 100 cases were studied in this series during the period from June, 1976 to December, 1977, and the selection of patients were made on detailed clinical history, thorough physical examination and relevant laboratory investigations prior to hospitalization in the Department of Obstetrics and Gynaecology, Patna Medical College Hospital, Patna. Out of these 100 cases, 66 had intra-amniotic saline instillation and 34 cases had hysterotomy for the termination of pregnancy.

After amniocentesis, 20% solution of hypertonic saline was instilled by slow drip. Maximum quantity injected was 200 ml. which is 40 gm. of NaCl. Small volume was injected in smaller uteri when less fluid had been aspirated but not less than 120 ml.

Majority of cases acted within 19-36 hours and while carrying 16-20 weeks which shows the optimum time of action and favourable period of gestation.

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TABLE I
Instillation Abortion Interval With Reference to Gestational Age

Duration in hours	16-18 weeks		18-20 weeks	
	No.	%	No.	%
Within 12 hours	Nil	0	Nil	0
13-18	6	20.0	4	11.1
19-24	12	40.0	10	27.8
25-36	10	33.3	20	55.6
37-48	2	6.7	2	5.6

The foetuses as a whole and their different viscera were studied morphologically and histologically, and the results were compared to 24 foetuses obtained after hysterotomy from individuals who had no instillation of hypertonic saline intra-amniotically. The changes in various organs (heart, lung, liver, kidney, spleen, brain and skin) were studied at different periods of gestation i.e. 16, 18 and 20 weeks of gestation.

The most important changes in all the organs were related to vascular bed of the foetus. These changes were characterised by congestion and engorgement, haemorrhage, oedema and dilatation.

The pathological changes in heart in all the periods of study (16, 18 and 20 weeks gestation), the commonest findings were oedema (36.6%) and haemorrhage (27.2%), congestion (24.2%), while dilatation of blood vessel (6.6%) and engorgement (5.5%) were seen in least number of cases (Fig. 1).

The lungs showed haemorrhage (42.4%), congestion (9.0%) and oedema (12.1%) (Fig. 2).

The changes in the liver were more noticeable in foetuses with the period of gestation beyond 20th week indicating that with the increase in period of gestation, the morphological changes appeared more advanced. Haemorrhage, patchy necrosis, cloudy swelling and intravas-

cular fibrin were seen in large percentage of cases (Fig. 3).

Kidney showed shrinkage of renal tubules (51.5%), haemorrhage (41.6%) and congestion (33.3%). In a few instances there were also evidence of intravascular congestion, oedema and thrombi. The changes in the kidney is characterised by cellular dehydration and the shrinkage of convoluted tubules was similar to those described in acute salt poisoning of infants (Elton *et al*, 1963) and hypernatraemias described by Stander *et al* (1971) (Figs. 4 and 5).

As expected, spleen showed maximum degree of congestion (60.6%) and haemorrhage (22.8%) progressively getting more marked as the period of gestation increased. Patchy necrosis though mild was seen in all the spleens studied.

Patchy necrosis was the most conspicuous findings when brain tissue was studied. Haemorrhage (57.5%) in brain tissue however, remained as an important feature during all weeks of gestation followed by congestion (24.2%) and oedema (11.1%) (Fig. 5).

Discussion

When a tissue is bathed in a hypertonic solution there is bound to be osmotic changes of the water and electrolytes. This is also what happens when hyper-

tonic saline is instilled in amniotic sac. Firstly, there is hypervolaemia within the sac. Consequent to this there is more inflow of fluid from the maternal end, and outflow of sodium to the maternal end, bringing about excessive amount of sodium in the serum and the urine, and hypervolaemia in maternal end. Such osmotic changes have already been demonstrated by several workers (King *et al.*, 1964 and Brewer *et al.*, 1963). Thus, it could be inferred that similar changes occur between the hypertonic amniotic fluid and the foetus. But in cases of foetus other than osmotic changes which takes place via the skin as reported by Bengtsson and Stormby (1962), other routes of exchange like placenta and probably the decidua through the membranes are also available (Fuchs, 1967).

According to Galen *et al.* (1974) more important site of osmotic changes with saline abortion is the umbilical cord. This assumption is based on the reports of other workers (Hutchinson, 1959), who has demonstrated umbilical cord as a very important pipeline for disposal of amniotic fluid. Still other routes through which osmotic changes could take place are the gastrointestinal tract and the respiratory system. (Abramovich 1970 and Ostergard 1970).

The morphological changes in the foetus definitely indicate that osmotic changes between foetus and the surrounding hypertonic amniotic fluid take place through different routes. The changes which are present in the skin resemble that of acute salt poisoning of infants (Elton *et al.*, 1963) and in acute oral toxicity of salt as observed experimentally by Boyd and Shanas (1963). It has been calculated that fatal dose of sodium chloride in human subject is about 0.8

gm. per kilogram of body weight by oral route. The amounts of sodium chloride injected during most saline abortions far exceed the lethal dose as far as the foetus is concerned.

The normal osmolarity of liquor amnii in 17 to 21 weeks pregnancies varies between 121 and 204 mOsm. per kilogram with sodium concentration between 44 and 96 mEq. per litre (Abramovich, 1970). Anderson and Turnbull (1968) observed sodium concentration greater than 2,000 mEq. per litre following injection of 200 cc. of 20 per cent sodium chloride solution at 16 to 80 weeks gestation.

The high index of correlation by Kovacs and associates (1970) between the initial maximal concentration of sodium and time of foetal death gives extra support for the impression that acute salt poisoning is the most important factor to produce foetal death. The work of Galen *et al.* (1974) also demonstrates that in saline abortion, the rate of exchange between hypertonic liquor and foetus is probably greater than during normal period of gestation. This is because of the availability of additional routes of osmotic changes and also because normal percentage of water of foetal tissue is much great than maternal tissue.

Therefore, it is presumed that instillation of hypertonic saline intra-amniotically results in acute salt poisoning of foetus with consequent foetal hypertonicity leading to widespread vascular dilatation, oedema, congestion, haemorrhage, shock and death. It is suggested that the early foetal death brings about the release of thromboplastin from the necrosed foetal tissue which is necessary for initiation of uterine contraction.

Summary

Histological changes in different organs of foetus were studied in 66 probands. Thirty-four controls consisted of normal pregnant women in which the abortion was brought about by hysterotomy. 200 cc. of 20% hypertonic saline was injected into the amniotic sac and the different organs of foetus were studied histologically.

The tissue studied were of heart, lung, liver, kidney, spleen, brain and skin of the foetus. The basic changes were varying only. The changes in heart consisted of oedema, haemorrhage and congestion. In lungs, the changes were particularly remarkable for extensive haemorrhage and were more marked than in any other organ. Alveolar distension oedema vascular congestion were other important changes observed. Liver changes were characterised by congestion, haemorrhage, patchy necrosis, cloudy swelling and intravascular fibrin deposit. Kidney revealed shrinkage of renal convoluted tubules as morphological evidence of cellular dehydration. Haemorrhage and congestion were also appreciable. Spleen also exhibited fair degree of congestion followed by patchy

necrosis and haemorrhage. Brain showed haemorrhage as a significant change.

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