YOLK SAC & ITS SIGNIFICANCE IN FIRST TRIMESTER OF PREGNANCY

PRATAP KUMAR ● SRIDEVI VELLANKI

SUMMARY

Transvaginal sonography observation of Yolk sac in first trimester pregnancy gives valuable information & prognosis could be assessed. 100 early pregnancies were analysed with 118 sonographic examinations. Among them 89 scans showed normal outcome & 29 had abnormal outcome. The earliest gestational age at which yolk sac was at 5 weeks & disappeared at 9 weeks when gestational sac was 9 mm. The mean diameter of yolk sac was 4.199 mm.

At 5, 6, 7, 8, & 9 weeks the yolk sac had mean diameter of 3, 4.67, 4.37, 4.71 & 4.29 mm; with S.D. of 1.41, 0.89, 0.77 & 2.52 respectively. With abnormal shape & size of yolk, outcome of pregnancy was abnormal. Accuracy of yolk sac was 63.6% sensitivity, 96.4% specificity, 72.7% positive predictive value & 93.2% negative predictive value. Yolk sac is important to be observed since it has some essential functions. Hence prior to starting treatment a careful yolk sac observation will decide further management.

INTRODUCTION

Rapid development in Technology of real time ultrasound has revolutionised the practice of obstetrics. Transvaginal sonography represents a new approach in early pregnancy evaluation.

Yolk sac is the first structure to be seen normally within the gestational sac and has significant role in early pregnancy.

MATERIALS & METHODS

Hundred early pregnancies were evaluated by Transvaginal Sonography with

Dept. of Obs. & Gyn., Kasturba Medical College, Manipal.

Accepted for Publication on 31.1.95

emphasis on yolk sac observation. There were a total of 188 sonographic examinations performed. Among them 89 scans showed normal outcome & 29 had abnormal outcome & the detailed analysis is shown below.

OBSERVATIONS

The earliest gestational age at which Yolk sac was identified was at 5 weeks, when gestational sac measured 9mm. Yolk sac was not seen beyond 9 weeks. The mean diameter of yolk sac was calculated as 4.199 mm in normal cases.

As shown in Table 1 between 5 & 9 weeks gestational age there was 100% frequency of yolk sac with a mean diameter (mm) of 3, 4.67, 4.37, 4.71, 4.29 at 5, 6, 7, 8 & 9 weeks. The standard deviation was 1.41 at 5 wks, 0.89 at 6 wks. 0.92

Table I

Yolk sac observation

Gestational age (wks)	Frequency of occurrence	Mean diameter (mm)	SD
5	100	3	1.41
6	100	4.67	0.89
7	100	4.37	0.92
8	100	4.71	0.77
9	100	4.29	2.52

Table II

Gestational Sac

Gestational age (wks)	Mean Gestational Sac diameter (mm)	SD
5	9.0	0.0
6	16.36	2.19
7	24.37	3.84
8	30.94	4.44
9	35.29	3.41
10	41.82	3.54
11	49.75	1.26
12	56.0	

at 7 wks, 0.77 at 8 weeks & 2.52 at 9 weeks. In case of abnormal outcome yolk sac was found to be abnormal in both size & shape. Accuracy of yolk sac was as follows:- sensitivity 63.6%, specificity 96.4%, positive predictional value 72.7% & a negative predictive value of 93.2%.

The Gestational sac for the various period of gestation is shown in Table II and the range was between 9 mm to 56 mm between 5 & 12 weeks.

DISCUSSION

Yolk sac is an important observation for evaluation of early pregnancy. A large, irregular, mobile yolk sac is an abnormal observation & is suggestive of abnormal conceptus. When normal, has a very regular circular structure, bright echogenic rim around a sonolucent centre. The essential functions of yolk sac include

(1) Provision of essential nutrients to the developing embryo.
(2) First site of haematopoeisis
(3) Origin of Primary germ cells that eventually form spermatocytes &
(4) Development of embryonic endoderm which forms the primitive gut.
(5) Initial site of AFP, prealbumin, albumin & transferrin.

Lindsay et al (1992) & Levi et al (1990 and 1992) have shown a sensitivity of 26.9% & 67% as compared to 63.6% in the present study. Specificity was 92.7% & 100% as compared to 96.4% in our study. The positive predictive value was 51.1% & 100% in the studies by Lindsay et al (1992) and & Levi et al (1990 and (1992) as compared to 72.7% in the present study.

Human data indicate that yolk sac malformations occur in embryo of diabetic mothers in the first trimester of pregnancy. In patients between 8-12 menstrual weeks, yolk sacs less than or equal to 2 mm were associated with poor outcome. Abnormal embryologic development is highly probable if a yolk sac is not visible in gestational sac larger than 8 mm & is invariably abnormal if a high quality sonogram fails to show a yolk sac when gestational sac measures 10 mm or more Nyberg et al. (1992) yolk sac abnormal in size or appearance may also suggest pregnancy failure. (Lindsay et al. 1992 and Croocj et al 1982)

Epidemiological & clinical studies have indicated that anomalies can be caused during organogenesis, at a time when the embryo & its extraembryonic membrane (the yolk sac) function as an independent unit (Reece A et al. 1988) During this period, the yolk sac develops vitelline vessels & hematopoietic function to sustain & provide cellular precursors for the developing embryo. Thus yolk sac failure during this critical period of organogenesis may result in secondary embryopathy. Yolk sac is the target site for metabolic fuels. Hence, yolk sac failure occurs during the histotrophic phase or during the early hemotrophic phase of nutrition, it could result in embryo death and pregnancy wastage. If embryopathy occurs later in the hemotrophic nutritional stage or is less severe, the embryo may survive but may be compromised or anomalous in proportion to the degree of yolk sac failure. The evolving data point to a three stage process. (1) Damage to the bilayered provisceral yolk sac, which leads to failure of vitelline vessel angiogenesis (2) Blocked transfer of hematopoeitic elements from the yolk sac to the recipient embryo & the egress of metabolites from

the embryo and (3) resultant embryo asphyxia, damage and / or compensatory embryonic responses, which result in organogenetic defects.

The early developmental nutrition are of three types (a) Histotrophic <2 weeks (pre yolk sac) (b) Hemotrophic 2-5 weeks (yolk sac) and (3) Placental >5 weeks (placenta). The structural exocoelomic cavity at a time when the hemochorial placenta is still imperfectly. Constituted provide further evidence in favour of the yolk sac's vital nature. The Primary yolk sac is called the "Provisceral" yolk sac because the portion of the Primary yolk sac in direct contact with the infolding embryo becomes incorporated into the embryo to form embryonic cells & tissues. Only the remaining portion of the yolk sac (secondary yolk sac) that is pinched off or extruded remains attached to the embryo after the fourth week of gestation is connected by the vitelline duct. Thus, this residual yolk sac is truly `secondary' yolk sac. Formation of the CNS, CVS, GI system occur during the time that the provisceral portion of the yolk sac becomes incorporated into the embryo to seed the hematopoietic system and to form the primitive gut, the epithelial lining of the respiratory & digestive tracts, gamete precursors & the lining of the liver, gall bladder, bile duct, pancreas, duodenum & small, large intestines. With the establishment of the first primary provisceral yolk sac circulatory system in the embryo during organogenesis nutrition becomes hemotrophic i.e. from the mother to yolk sac & then from yolk sac to embryo. Because the trophoblast derived hemochorial placenta is immature at this early state of gestation, it seems logical that there is an alternate route of substract delivery to sustain the developing embryo.

CONCLUSION

The major sonographic applications of the evaluation of yolk sac are

(1) Differentiation between potentially viable & non-viable pregnancies.

(2) Confirmation of the presence of an intrauterine pregnancy.

REFERENCES

1. *Levi C S, Lyons EA, Lindsay DJ; Radiologic clinics of North America vol 28 (1) Jan 1990.*
2. *Lindsay DJ, Lovett I S, Lyons EA., Levi c., Zheng Xin H., Holt S., Dashefsky S., Obstet Gynecol Survey 47, 11, 760 1992.*
3. *Levi C S, Lyons EA, Lindsay DJ; Radiology 167, 383, 1988.*
4. *Nyberg DA, Laing Faye C; TRansvaginal ultrasound 1st edn 1992.*
5. *Croocj MJ., Westhius M, Schoemaker J., Exalto N. Brit.J.Obstet. Guynec.89:931,1982.*
6. *Reece A, Sciosia A, Pinter E., Hobbins J., Green J., Mahoney M., Naftolin F., Am.J.Obstet. Gynec. 159:1191,1988.*