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# Digital analysis of the volume of the human foetal suprarenal arteries

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*Vascularisation of an organ is an index of its metabolic activity. The suprarenal glands are of crucial importance in the development of pregnancy. No data were found by the authors to describe the volume of the human foetal suprarenal arteries throughout pregnancy. The study was designed to form a database of human foetal suprarenal arterial volume in relation to foetal age and sex.*

*Digital images were obtained at 4-week intervals of the suprarenal arteries of 30 foetuses aged between 12–40 Hbd. The arteries were primarily filled with LBS latex. A unique form of software was designed to assist in incorporating vector graphics, spliced functions of Bezier, into the analysis. The arteries contoured by the geometric curves were calculated for their initial, average and terminal diameter, length and volume. The measurements were compared in relation to foetal age and sex at 4-week intervals. Foetal age was assessed by means of calculation from the last menstrual period, manual measurement of foot length and ultrasonagraphic measurement of femoral length.*

*The suprarenal arteries in human foetuses are of strongly individual variation both in their origin and quantity. The volume of the arteries appears constant in the group analysed.*

**key words: suprarenal artery, foetus, digital image**

## INTRODUCTION

In the human foetus the suprarenal glands are one of the largest organs in the entire body. Their cortex plays a role in steroid synthesis, developing a thick foetal layer. After the delivery they then undergo rapid reconstruction, in which the foetal layer disappears and is replaced by a typical three-fold structure of glomerular, fasciculate and reticular zones. Arterial vascularisation of the suprarenal vessels is a remnant of the embryonic development of the intermediary mesothelial crest. The authors found no data in the literature on evaluation of suprarenal arterial volume.

## MATERIAL AND METHODS

30 foetuses of both sexes (13 males and 17 females) were introduced into the study. Foetal age was assessed at 13–19 weeks of pregnancy, by a comparison of the foot length and femur length [6]. The arterial circulatory system of the foetuses was filled with a mixture of 30% suspension of LBS latex and a detergent through a catheter inserted into the descending aorta. After a 4% formaldehyde immersion latex had clotted, the foetuses were dissected under binocular microscope magnification. The suprarenal arteries were identified, photographed *in situ* (Olympus Camedia 4040; 2272 × 1704 pix,

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**Figure 1.** Suprarenal arteries of a foetus filled with latex.

24 bit, BMP) (Fig. 1). Unique software was developed to apply Bezier's curves to the measuring procedure.

## RESULTS

Because of the different patterns of distribution of the arterial branches, the major stem and primary branch were measured. In the group studied the total volume of the suprarenal arteries in human foetuses showed a flat distribution (Fig. 2). No differences were noted between the left and the right arteries. The volume of the suprarenal arteries was comparable for both sexes (Fig. 3, 4, Table 1).

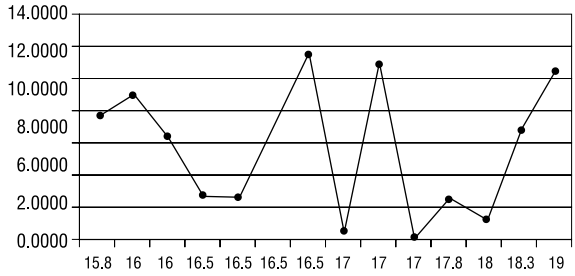


**Figure 2.** Total volume of the suprarenal arteries.

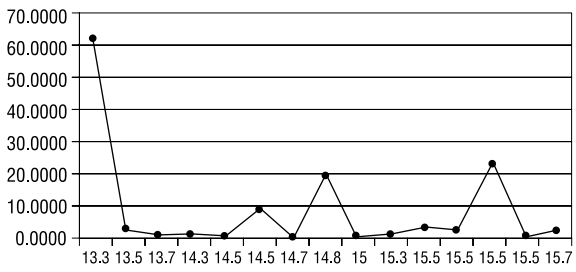


**Figure 3.** Volume of the suprarenal arteries in female foetuses.

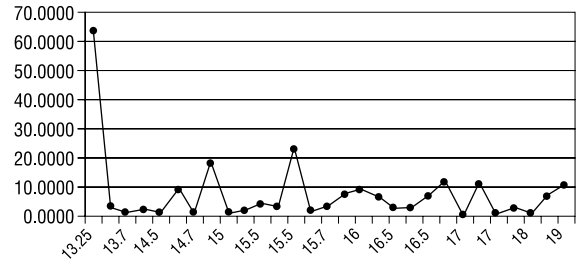


**Figure 4.** Volume of the suprarenal arteries in male foetuses.

**Table 1.** Volume of the suprarenal arteries

| Age [weeks] | Total volume | Sex |
|---|---|---|
| 13.25 | 62.5973 | F |
| 13.5 | 3.0632 | F |
| 13.7 | 1.3743 | F |
| 14.25 | 2.3701 | F |
| 14.5 | 1.4755 | F |
| 14.5 | 9.2765 | F |
| 14.7 | 1.3148 | F |
| 14.75 | 19.4634 | F |
| 15 | 1.6259 | F |
| 15.25 | 2.3722 | F |
| 15.5 | 4.1593 | F |
| 15.5 | 3.1185 | F |
| 15.5 | 23.5661 | F |
| 15.5 | 2.2500 | F |
| 15.7 | 3.4393 | F |
| 15.75 | 7.7974 | M |
| 16 | 9.1304 | M |
| 16 | 6.4490 | M |
| 16.5 | 2.7645 | M |
| 16.5 | 2.7697 | M |
| 16.5 | 6.9464 | M |
| 16.5 | 11.7663 | M |
| 17 | 0.6195 | M |
| 17 | 11.0777 | M |
| 17 | 0.1962 | M |
| 17.75 | 2.6984 | M |
| 18 | 1.4755 | M |
| 18.25 | 7.0460 | M |
| 19 | 10.6559 | M |


**Figure 5.** Suprarenal artery in Doppler ultrasound.


**Figure 6.** Inferior suprarenal artery twigging off from the renal artery.

## DISCUSSION

In the group studied the suprarenal arteries showed high variability in the origin of all the vessels, which is similar to the findings other authors [1, 6] Surprisingly, despite the rapid growth of a foetus between the 13$^{th}$ and 19$^{th}$ week of pregnancy, the suprarenal arteries do not increase in volume, which may indicate either minimal growth of the suprarenal gland or its constant metabolic and endocrinal activity.

Anatomical studies on the suprarenal glands focus on the variations in the arteries [2, 4, 7]. Arterial blood flow is mostly analysed only by means of Doppler ultrasound *in vivo* (Fig. 5, 6), which allows for speed and quality of measurement rather than for the quantity of the stream [3]. Blood flow into the gland is of key importance for the foetus and sparing of the organ, as proved in dynamic methods [5]. Our data, when further developed, may contribute to a quantitative analysis of blood flow through the foetal adrenals.

## CONCLUSIONS

The volume of the suprarenal arteries showed no dynamics in growth between 13th and 19th week of pregnancy. The reasons for such a state need further investigation.

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