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A Study of Distribution Pattern of Chorionic Arteries & Veins in Full term Placenta: Through dye injection method.

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ABSTRACT

This is well known fact that placenta is one of the most important anatomical structure in term of nutrition to fetus is concerned. Advancement in our initial knowledge of implantation and embryological development provided us an important reason for this study on vascular pattern fully functional and mature placenta. To study distribution pattern of chorionic arteries & veins in full term placenta. To find out various types of distribution pattern of chorionic arteries & veins of placenta, dye was put into umbilical arteries & vein. In umbilical vein eosin & in umbilical arteries methylene blue dyes were put by 5 ml plastic syringe and each chorionic vessel was traced to find out their distributing pattern. Distributing pattern of chorionic blood vessels of placenta were observed & they were found to be - Dispersal and Magistral type, of which, Dispersal type of distribution was predominant in both arteries (64%) and veins (60%). It was concluded that there are two types of distributive pattern of chorionic arteries and vein namely dispersal and magistral out of which dispersal type is predominant vascular pattern.

Keywords: Placenta, Umbilical arteries, Umbilical veins, Chorion, Dispersal pattern and Magistral pattern

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INTRODUCTION

Placenta is an anatomical structure, which begins to develop during early pregnancy. All important functions for survival of embryo like nutrition, excretion, respiration & protection etc are performed by placenta [1]. The shape of human placenta varies from circular to oval with a diameter of 15 to 20 cm and its thickness & weight ranges from 2 to 3 cm & 500 to 600 gm respectively [2,3 & 4]. The surface of placenta facing the embryo is smooth and having network of arteries & veins which are called as chorionic arteries & veins [5].

There had been several methods utilized by the different authors to study gross anatomy of distribution of chorionic arteries and veins of human placenta like angiography, microscopy, latex or plastic casts & gelatin dye injection method. According to Schordania J. (1929) vascular pattern of placenta is not a haphazard phenomenon, but is genetically determined by vascular characteristics of mother [6]. The character of fetal placental blood vessel can be recognized as early as 12th wk pregnancy. In the beginning the arrangement of chorionic arteries and veins of human placenta was described to be like that of spokes of wheel⁴. Some authors have described the arrangement of chorionic arteries and veins like radiation of a star. Branches of chorionic arteries and veins are categorized into primary, secondary and tertiary categories.

Recently some authors described the distribution pattern of chorionic arteries and veins are of dispersal and magistral type. [6,7]. In dispersal type / dichotomous pattern, umbilical vessels undergo successive divisions with gradually diminishing caliber towards periphery, giving it a star like appearance. While in magistral type vessels reaching up to margins of placenta with no drastic decrease in caliber.

A large doubt is still present in distribution pattern of chorionic arteries and veins of placenta among various studies. Therefore present study was conducted to establish the better understanding of distribution pattern of chorionic arteries and veins of fully established human placenta.

METHODOLOGY

It is a dye assisted observational study which was done in the Department of Anatomy, Integral Institute of Medical Sciences & Research, Integral University, Lucknow, India.

After taking clearance from institutional ethical committee, a total of fifty human placentae of normal term pregnancy without any other complication were collected just after parturition from labor room of Department of Obs. & Gynae. Placentae with intact 6 cm of umbilical cord were washed with distilled water, blood clots were removed by applying gentle pressure over chorionic arteries & veins followed by saline irrigation.

Cut end of intact umbilical cord was visualized by hand lens carefully to find out umbilical arteries and vein for purpose of infusion of dye. 5- 10 ml methylene blue & 0.5% eosin were injected in the both umbilical arteries & umbilical vein respectively, to enhanced the distribution pattern of chorionic arteries and veins. After enhancement of chorionic arteries and veins, each vessel was followed and examined to count its branches and distribution pattern.

RESULTS

After injecting the dye we observed the distribution pattern of chorionic arteries and veins with their number of branches and the observation were noted & tabulated.

Pattern in chorionic arteries

- After putting the dye in umbilical arteries it was found that branching pattern of chorionic arteries and veins divide many times in dichotomous fashion, with gradual decrease of caliber from central part to peripheral part. i. e. the dispersal pattern (Fig. 1) in 64% (in 32 placentae). The maximum placentae (17 n) showing this pattern had 4 to 5 primary branches (Fig. 3).

- In 32% (in 18 placentae) the chorionic vessels distributed by few branches which run before the placental margin without marked reduction in caliber i. e. Magistral pattern (Fig. 2). In this type of pattern majority placentae showed 1-3 primary branches (fig 4). All the findings are tabulated in table no 1 and 2.

Pattern in chorionic veins

After putting the dye in chorionic veins Dispersal pattern in veins 60% (in 30 placentae) (Fig 1) and Magistral pattern was found in veins 40% (in 20 placentae) (Fig 2). In the dispersal type of distribution chorionic veins have 3-5 tributaries (fig. 5) while in magistral there were 1-3 tributaries (fig. 6). These finding are tabulated in table 1 and 2.

Table 1: Distribution Pattern of chorionic arteries and veins.

Chorionic Vessels	Type of Pattern	Number of Placenta	Percentage (%)
Arteries	Dispersal	32	64
	Magistral	18	36
Veins	Dispersal	30	60
	Magistral	20	40

Table 2: Number of Primary Branches of Chorionic Arteries and Veins

Number of Branches or tributaries	1	2	3	4	5
Dispersal Pattern(Total = 32)	04	04	07	09	08
Magistral Pattern(Total = 18)	07	07	04	00	00
Dispersal Pattern(Total = 30)	05	07	08	06	04
Magistral Pattern(Total = 20)	03	12	05	00	00

DISCUSSION

Placenta and umbilical cord (consisting of two umbilical arteries and one umbilical vein) form a transport system for substances passing between mother and embryo / fetus. Nutrients and oxygen pass from maternal blood through the placenta to embryo / fetal blood and waste materials and carbon dioxide pass from fetus to mother. Mature placenta and fetal membranes perform various functions included safety of fetus, nourishment, gaseous exchange, elimination of metabolic wastes as well as endocrine functions etc.

The branches of chorionic vessels of the placenta provide a large surface area where materials may be exchanged across the very thin placental membrane interposed between the foetal and maternal circulations. In case of fetal circulation the arteries divide into several radially disposed chorionic arteries that branch freely in the chorionic plate before entering the chorionic villi. The welfare of the embryo / fetus depends more on the adequate bathing of the branch villi with maternal blood than any other factor. Reductions of utero-placental circulation result in foetal hypoxia and intrauterine growth restriction (IUGR) & severe reductions of circulation may result in embryo / fetal death.[8]

In the present study 32 cases (64%) have dispersal, 18 cases (36%) have magistral distribution pattern of chorionic arteries while 30 cases (60%) have dispersal& 20 cases (40%) have magistral distribution pattern of chorionic veins (Table1).

When compare with other previous studies it has been found that the pattern of both chorionic arteries & veins ranges from 60% - 70% dispersal type & from 40% - 30% magistral type except study of Laxmidevi CK et al [9] in which all 100% pattern were dispersal type. A comparison of result of present study has been compared with the results of previous studies in table 2-3.

Table 3: Comparison of Distribution Pattern of Chorionic Arteries and veins

Author	Placenta	Arteries		Veins	
		Dispersal	Magistral	Dispersal	Magistral
Laxmidevi CK et al [9]	50	50 (100%)	---	50 (100%)	---
Verma R et al [10]	200	126 (63%)	74 (37%)	126 (63%)	74 (37%)
Sarwar MY et al [11]	150	94 (64%)	54 (36%)	94 (64%)	54 (36%)
Verma S et al [12]	20	14 (70%)	06 (30%)	13 (65%)	07 (35%)
Sridevi P et al [13]	70	45 (64.2%)	25 (35.7%)	47 (67.1%)	23 (32.8%)
Rohinidevi M et al [14]	50	31 (62%)	19 (38%)	30 (60%)	20 (40%)
Gupta A et al [15]	100	60 (60%)	40 (40%)	63(63%)	37 (37%)
Present Study	50	32 (64%)	18 (36%)	30 (60%)	20 (40%)

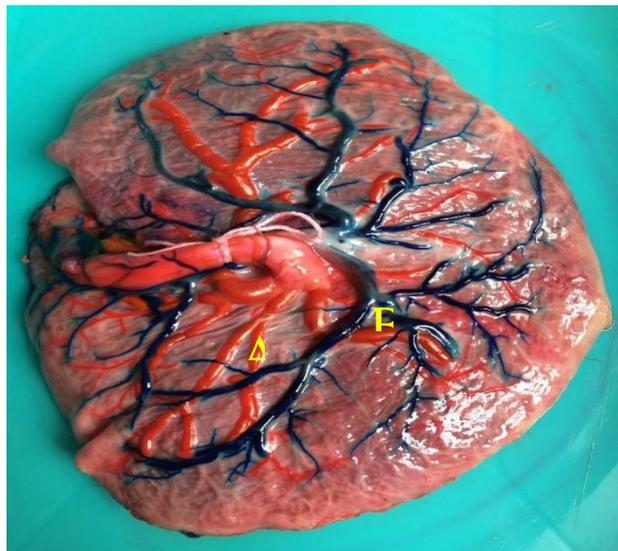


Figure 1: Dispersal type distribution A - Chorionic Artery & B - Chorionic Vein showing multiple branching

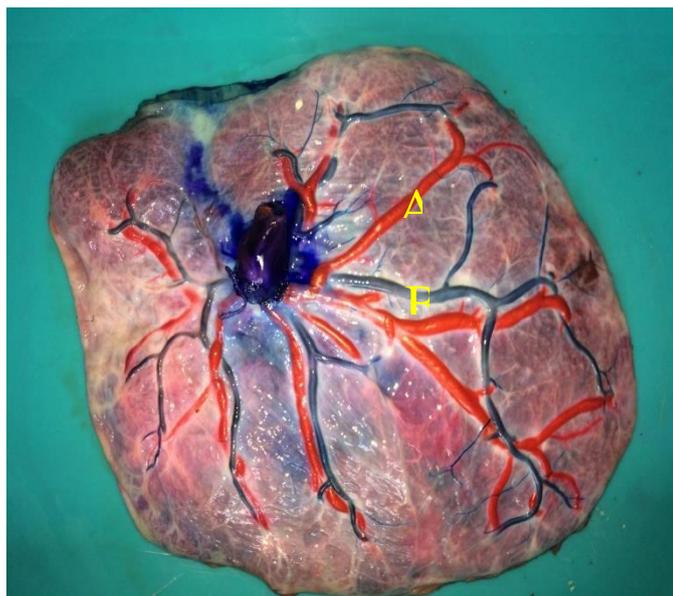


Figure 2: Magistral type distribution A - Chorionic Artery & B - Chorionic Vein showing less or no branching

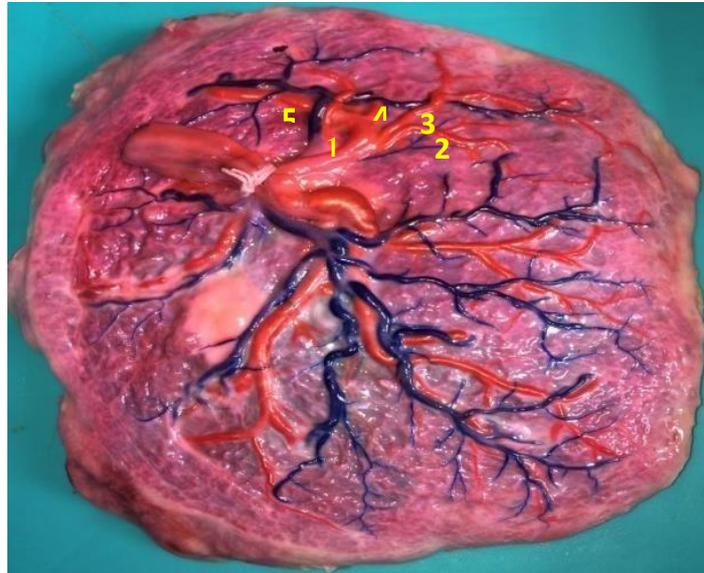


Figure 3: Dispersal type distribution showing multiple branching 1, 2, 3, 4 & 5 in Chorionic Artery

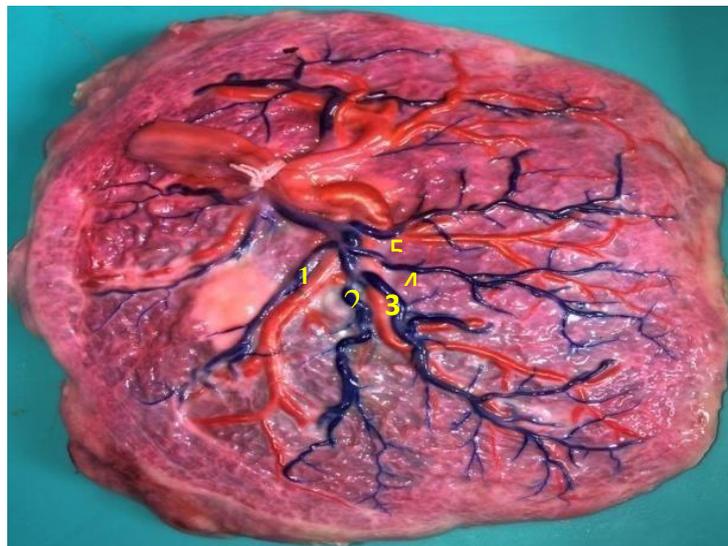


Figure 4: Dispersal type distribution showing multiple branching 1, 2, 3, 4 & 5 in Chorionic Vein

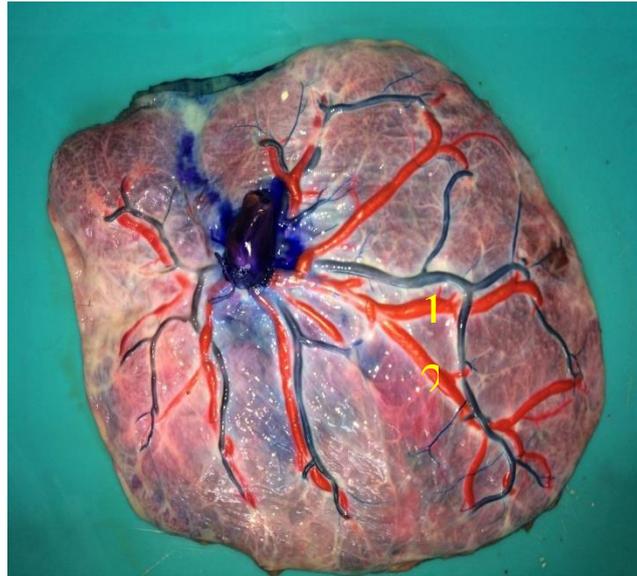


Figure 5: Magistral type distribution showing less number of branching 1 & 2 in Chorionic Artery

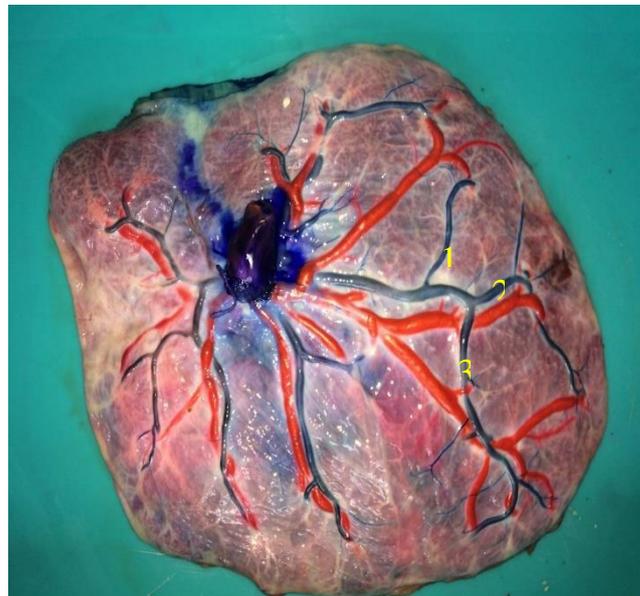


Figure 6: Magistral type distribution showing multiple branching 1, 2 & 3 in Chorionic Vein

CONCLUSION

Present study gives knowledge about distribution pattern of chorionic arteries and veins of fully established human placentae, which may be - dispersal & magistral. Dispersed type of distribution pattern of chorionic arteries and veins was dominant over magistral type of distribution pattern.

List of abbreviations

cm	centimeter
gm	gram
ml	milliliter
wk	week

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