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Pattern Recognition of Cardiac Arrest In Neonates Using Machine Learning Techniques

Ketan Gupta

Abstract

The period from which a baby is born estimated as four weeks after the last day of birth has a chance to suffer cardiac arrest. Cardiac arrest in the newborn is often heard in children of childbearing age. This news is encouraging to young mothers, causing them anxiety and sleeplessness. Since the origin of the sadness must be clarified, there is certainly reason for observation, because it can indicate a serious illness. This is the case when awareness is not required. Regardless of everything, after a careful examination, it is much nicer than not to have time and opportunity to restore the health of the child. In this paper, Pattern Recognition has proposed of Cardiac Arrest in Neonates Using Machine Learning Techniques. Foreign sounds heard in the pause between tones are called cardiac arrests; they do not take into account the characteristics of the normal activity of the heart, drowning out its tones. Anatomic anomalies of cardiac origin make up a third of all, prompting an increase in the frequency of this pathology. Approximately 0.7-1.2% of children are born with heart defects, and most of them die by the end of the first year of life without surgical correction. The probability of having a child with structural abnormalities of the heart and blood vessels in the family, where there is already a child with this disease, is slightly higher - about 5%.

Keywords:

Cardiac Arrest;
Newborn;
Children;
Serious Illness;
Pattern Recognition;
Anatomic anomalies;

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1. Introduction

A systolic cardiac arrest in a newborn's heart is not very distinctive. Most early systolic cardiac arrests are functional, however, panstilicol, which is heard intermittently throughout the systolic phase between the heartbeat and the cardiac arrest, is considered dangerous [1]. Such noises speak of valvular deficiency and the propagation of the gap of the atrium or obstruction from the blood vessel to the blood vessel [2]. Depending on the size of the hole between the left and right ventricles, this syndrome is manifested by oxygen deficiency, and the child develops dyspnea [3-4]. Systolic cardiac arrests may indicate aortic or pulmonary artery stenosis [5]. When there are minor abnormalities in the development of the heart, cardiac disorders are present [6]. At mitral restrictions - heart dilatation type noise occurs most often at the semilunar, and anomalies that provide the direction of flow from the ventricles of the aorta and blood vessel [7]. The cardiac arrest is usually systolic with arthritic or pulmonary artery diameter narrowing [8]. The first signs of severe genetic anomalies are mainly seen during genital examination or immediately after birth [9]. Experienced daughters accept a child and notice that everything is not right with him [10]. The child is weak, has no appetite, often pushes out, the skin on the hands and feet is bluish, the nail bed is pale, and the upper jaw is blue due to respiratory problems [11]. On auscultation, pronounced cardiac arrests, irregular heart rhythms and palpitations are detected. Blood pressure markers also vary from norm [12].

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More significant (minor developmental anomalies) are often diagnosed much later, but they have little or no effect on the functions of the cardiovascular system [13]. Small voices are said in a newborn without other symptoms, often indicating that the body is reorganizing and adapting to new conditions of the autonomic system [14]. Such noise usually passes in the first year of life and does not represent any risk for the child's development. Even a child of two to three months of age, the blood vessel, which usually closes after one, and two weeks after birth, for the vein that connects one half to the aorta, is allowed to open for a certain time [15-16]. However, it is pathological in children less than three months old. This is true for other moments of cardiac rehabilitation [17]. The rectangular oval window between the adrenal glands usually closes during the first month of the baby's life [18]. In some cases, it may be close to the achievement of a one-year-old child, but it does not affect hemodynamic. The child is healthy, develops normally, and is regularly monitored by the child's cardiologist [19-20]. The connection of the umbilical cord of the duct - veins and fetal capillaries of the central system, the unborn child is closed during the first and second hours of life, in some cases it takes more time, or the venous flow is maintained [21]. Therefore, if after an acceptable period of time, the anomalies of the heart structure do not disappear, they are considered as disadvantages and treatment depending on the effect on the function of heart diseases [22].

2. Related Works

Risk factors for congenital anatomic variations of the heart and large vessels are abundant enough. Genetics can play a negative role in the continuation of pathology of pregnancy, pregnancy, especially infectious and chronic diseases, drug treatment, miscarriage and infertility long and, taking non-pregnancy drugs and vitamins related to this treatment [23]. It is impossible not to take into account the unfavorable environmental situation in the place of permanent residence of a pregnant woman, as it makes her addicted to bad habits. This includes women above the age of 35 years [24]. An important factor in the chances of cardiac arrest in neonates in babies was a delivery obstetric section. Abnormal noise appears in the manner in which the activity of the main body of the muscle is connected to its turbulence, blockages or vascular defects, as it often causes gapping valves, changes in intracardiac pressure and blood flow speed in the main vessels [25]. Benign noises tend to appear prominently in the systolic phase of cardiac muscle activity during an increase in blood flow through semilunar valves (and aortic valves) that are structurally more normal. Unlike dangerous cardiac arrests created by structural anomalies of heart valves, chambers, or vital vessels, safe cardiac arrests are caused by blood flow alone [26]. A heart cardiac arrest is heard about every third innovation, however, always indicating the presence of disease. This is almost equivalent to a good heart sound in a baby being a sign of congenital heart disease [27].

A cardiac arrest is a very common occurrence in a heart born after a cesarean section. This surgery is performed only in severe cases, saving the life of the newborn and his mother [28]. This natural delivery process disturbs and runs an autonomous existence of the baby outside the abdominal organs. Nature has provided a child with a lot of work and this adaptation is going to be restructured, which is the natural process of birth [29]. Artificially stimulating life mechanisms is the operative way to get the body in a stressed state and carry out activities. A vital cycle falls from the process - light, first breath and cry, broken when the fluids expand in the circulation. Morphology, behavior, including cardiovascular, speaks for itself in the presence of serious deviations from the average, because there is no hope for a successful outcome of childbirth in a natural way, vaginal birth, in a way that is much more dangerous for children than surgical delivery [30].

3. Proposed model

The most important basis for noise classification is the cause of their occurrence. With the work of the heart, those extraneous sounds were made in newborns to be symptoms of a congenital defect of the heart muscle (pathological or organic cause), on the disappearing causes of the time in the heart's restoration and adaption of the normal life, can occur very innocent new conditions outside the mother's womb. Such noise represents a type of innocuousness, which is called functional or malicious. They can occur in completely healthy children and the causes of their appearance are called minor structural anomalies of the muscle and valve mechanism, which do not cause total violations of blood flow:

- Muscular filters in the left end of the heart (ectopic trabeculae or false heart);
- Open oval window;
- A long Eustachian valve and others

Many violations associated with minor anomalies of aging disappear because they are fragments of the ideological cycle. The most frequent causes of audible or dangerous cardiac arrest in neonates are congenital (the child is too young for birth defects) anatomical deviations:

- Marked valve anomalies: mitral prolapses and stenosis, combined insufficiency, tricuspid valve swelling;

- Defects of the septa that separate the inspiratory or pulsating heart;
- For vascular malformation, partial compression (stricture) aortic patency (after one year of age) severe degree of ducts arteriosus.
- Combined anomalies - lesions of two, three, four structural elements of the heart;
- Violation of position (displacement) of main ships;
- Abnormal drainage of the pulmonary veins (partial or complete)

Although they are persistent, they often have no significant effect on the quality of cardiac function. For example, valve prolapses, often - mitral, less often - tricuspid, and in most cases small waves are occasionally discovered accidentally. Severe cases of such diseases (very rare) can lead to circulatory disorders and require surgical intervention. The causes of the appearance of functional noise may be directly related to cardiac syndromes. Disappearing voices are heard when removing causes such as perfect infection, anemia, increased burden on the heart, childishness. Noxious or harmless noises are the most systolic cardiac arrests. Permanent throughout the systolic phase and when heard, appears in the diastolic phase of heart disease of the heart muscles, and - late systolic is considered dangerous. They blood flow, inevitably leads to total violations in other organs and tissues, a lack of essential nutrients leading to oxygen starvation, causes the heart muscle to fail. There are developmental anomalies that are incompatible with life. The proposed model flow diagram has shown in the following fig.1.

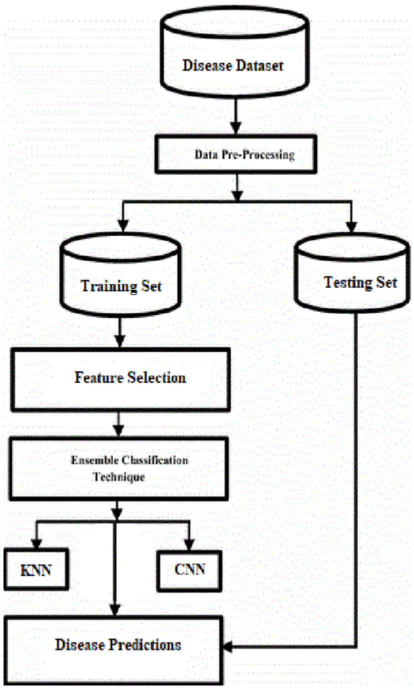

Figure 1. *Proposed flow diagram*

Depressive cardiac arrest in neonates caused by physiological causes can be overcome independently and treated. Small anatomic aberrant structural disorders of the heart muscle and great vessels are often age-specific and self-resolving. Vascular and pulmonary valve, most of them is affected by severe congenital heart disease - tetralogy of Fallot and improper location of the main blood vessels of the heart, the child needs immediate surgical intervention to save his life. Babies born with holes in the atria or holes between the ventricles are more frequent. The first diagnostic event takes place in maternity wards. New medical awareness requires conducting a visual examination and listening to the baby's heartbeat. Additional sounds, as well as - additional symptoms (cyanosis, dizziness, dyspnea) recommend further examination. Absence of murmur in the heart of a newborn does not mean that there are no defects of the heart muscles, although gross anomalies should be noticed immediately, and immediate intervention should be sought. In particular, the child needs a routine blood test to rule out lethargy and possible non-inflammatory processes. A biochemical blood test can be informative in some cases. Diagnostics as a tool that allows assessment of the condition of the heart of the newborn consists of the following steps:

- Electrocardiography - gives an idea of the basic parameters of the heart (rhythm, heart rate), and allows determining the degree of their deviations from the norm;
- Microphones where acoustics are recorded for their subsequent recognition;

- Ultrasound examination of the heart (echocardiography) is the most communicative method, which provides an almost complete picture of the organ and vital vessels, pressure, speed and direction of blood flow;
- Tomography (magnetic resonance or computer), perhaps by using contrast, allows the addition of data from previous tests, which can identify the best contrasts and features of the disease.
- Radiography and angiography are recommended if necessary
- Catheterization - performed as a diagnostic procedure, during which a minimally invasive intervention can be performed immediately to correct the heart valve defect.

The severity of this deficiency is directly proportional to the level of the tumor, and due to this irregularity, the mixture of arterial and venous blood is the result of the development of muscle hypoxia. Small holes often pass themselves, and if necessary, the hole is closed - accommodation for surgery. Often a timely operation restores the child's health completely, and he can live a full and long life. Non-corrective surgery for congenital heart defects or abnormalities is fraught with the development of secondary immunodeficiency and reduced life expectancy. Most infants (approximately 70%) die in the first year of life due to gross homodynamic defects due to cardiac abnormalities. With timely cardiac care, mortality is 10%. Time lost to surgery also leads to the development of irreversible disorders, especially various surgical complications

4. Results and Analysis

The proposed Pattern Recognition of Cardiac Arrest (PRCA) has compared with the existing EEG predicts outcomes (EPO), real-time mortality prediction (RMP) and Novel healthcare framework (NHF)

Heartbeat management: There are no rules without exception; however, heart attacks are a reflection of heart disease. A constant noise is heard - too. A systolic cardiac arrest in a newborn's heart is not very distinctive. Most early systolic cardiac arrests are functional, however, panstilicol, which is heard intermittently throughout the systolic phase between the heartbeat and the cardiac arrest, is considered dangerous. Such noises speak of valvular deficiency and the propagation of the gap of the atrium or obstruction from the blood vessel to the blood vessel. The Heartbeat management has shown in the following table 1.

Table 1. Heartbeat management (in %)

No.of Inputs	EPO	RMP	NHF	PRCA
100	51.00	72.62	61.34	94.27
200	45.14	79.46	55.93	94.37
300	46.28	80.75	54.44	94.44
400	45.14	82.89	51.20	94.49
500	44.26	81.32	51.92	94.53

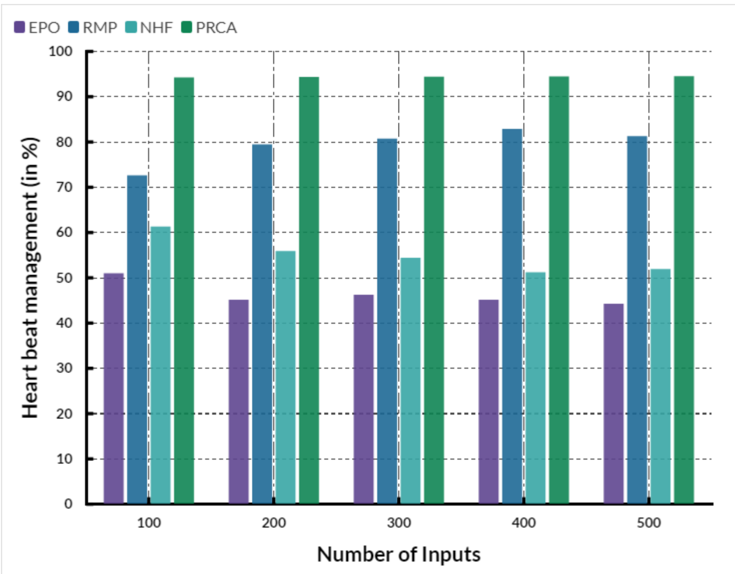

Fig 2: Comparison of Heartbeat management

The fig.2 shows the comparison of Heartbeat management. In a saturation point, the PRCA model achieved 94.44% of heartbeat management. But the existing EPO reached 46.28%, RMP achieved 80.75%

and NHF obtained 54.44% of heartbeat management. The proposed model achieved better results while compared with the existing models.

Abnormalities management: Depending on the size of the hole between the left and right ventricles, this syndrome is manifested by oxygen deficiency, and the child develops dyspnea. Systolic cardiac arrests may indicate aortic or pulmonary artery stenosis. When there are minor abnormalities in the development of the heart, cardiac disorders are present. At mitral restrictions - heart dilatation type noise occurs most often at the semilunar, and anomalies that provide the direction of flow from the ventricles of the aorta and blood vessels. The cardiac arrest is usually systolic with arthritic or pulmonary artery diameter narrowing. The Abnormalities management has shown in the following table.2

Table 2. Abnormalities management (in %)

No.of Inputs	EPO	RMP	NHF	PRCA
100	41.05	74.92	58.82	92.79
200	41.43	76.13	59.73	93.75
300	42.44	77.27	60.65	93.32
400	43.37	78.38	61.98	94.56
500	44.37	79.08	62.85	94.67

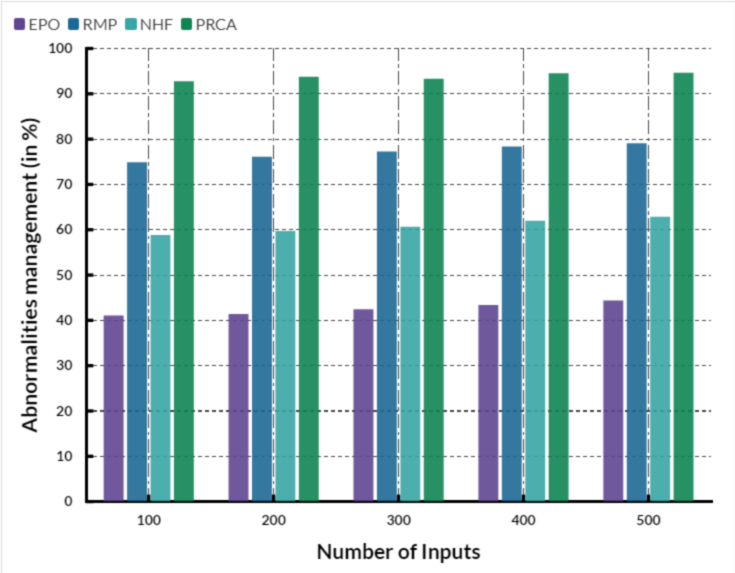

Fig 3: Comparison of Abnormalities management

The fig.3 shows the comparison of Abnormalities management. In a saturation point, the PRCA model achieved 93.32% of Abnormalities management. But the existing EPO reached 42.44%, RMP achieved 77.27% and NHF obtained 60.65% of Abnormalities management. The proposed model achieved better results while compared with the existing models.

Genital examination management: The first signs of severe genetic anomalies are mainly seen during genital examination or immediately after birth. Some experts accept a child and notice that everything is not right with him. The child is weak, has no appetite, often pushes out, the skin on the hands and feet is bluish, the nail bed is pale, and the upper jaw is blue due to respiratory problems. On auscultation, pronounced cardiac arrests, irregular heart rhythms and palpitations are detected. Blood pressure markers also vary from norm. More significant (minor developmental anomalies) are often diagnosed much later, but they have little or no effect on the functions of the cardiovascular system. The Genital examination management has shown in the following table.3

Table 3. Genital examination management (in %)

No.of Inputs	EPO	RMP	NHF	PRCA
100	43.16	71.62	55.13	91.43
200	44.66	72.21	57.00	92.47
300	45.77	73.19	57.83	92.60
400	46.15	74.40	58.74	93.56
500	47.16	75.54	59.66	93.13

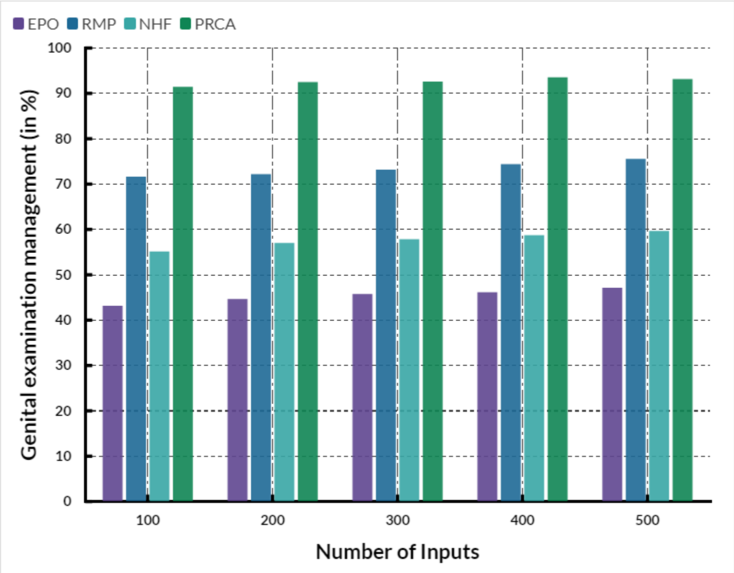

Fig 4: Comparison of Genital examination management

The fig.4 shows the comparison of Genital examination management. In a saturation point, the PRCA model achieved 92.60% of Genital examination management. But the existing EPO reached 45.77%, RMP achieved 73.19% and NHF obtained 57.83% of Genital examination management. The proposed model achieved better results while compared with the existing models

Noise Management: Small voices are said in a newborn without other symptoms, often indicating that the body is reorganizing and adapting to new conditions of the autonomic system. Such noise usually passes in the first year of life and does not represent any risk for the child's development. Even a child of two to three months of age, the blood vessel, which usually closes after one, and two weeks after birth, for the vein that connects one half to the aorta, is allowed to open for a certain time. However, it is pathological in children less than three months old. This is true for other moments of cardiac rehabilitation. The Noise Management has shown in the following table.4

Table 4. Noise Management (in %)

No.of Inputs	EPO	RMP	NHF	PRCA
100	52.72	63.65	54.84	93.03
200	51.22	63.06	52.97	92.02
300	50.11	62.08	52.14	91.86
400	49.73	60.87	51.23	90.90
500	48.72	59.73	50.31	91.33

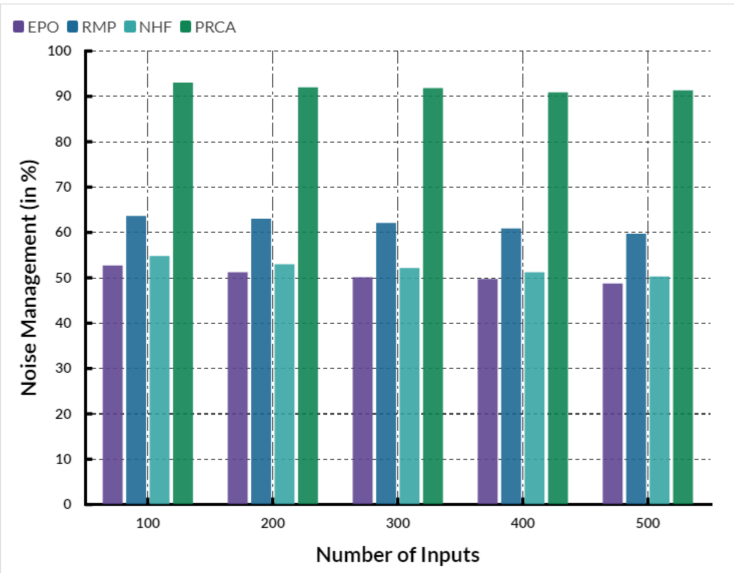

Fig 5: Comparison of Noise Management

The fig.5 shows the comparison of Noise Management. In a saturation point, the PRCA model achieved 91.86% of Noise Management. But the existing EPO reached 50.11%, RMP achieved 62.08% and NHF obtained 52.14% of Noise Management. The proposed model achieved better results while compared with the existing models

Health management: The rectangular oval window between the adrenal glands usually closes during the first month of the baby's life. In some cases, it may be close to the achievement of a one-year-old child, but it does not affect hemodynamic. The Health management has shown in the following table.5

Table 5. Health management (in %)

No.of Inputs	EPO	RMP	NHF	PRCA
100	65.02	60.25	52.10	93.94
200	63.52	59.66	50.23	92.90
300	62.41	58.68	49.40	92.77
400	62.03	57.47	48.49	91.81
500	61.02	56.33	47.57	92.24

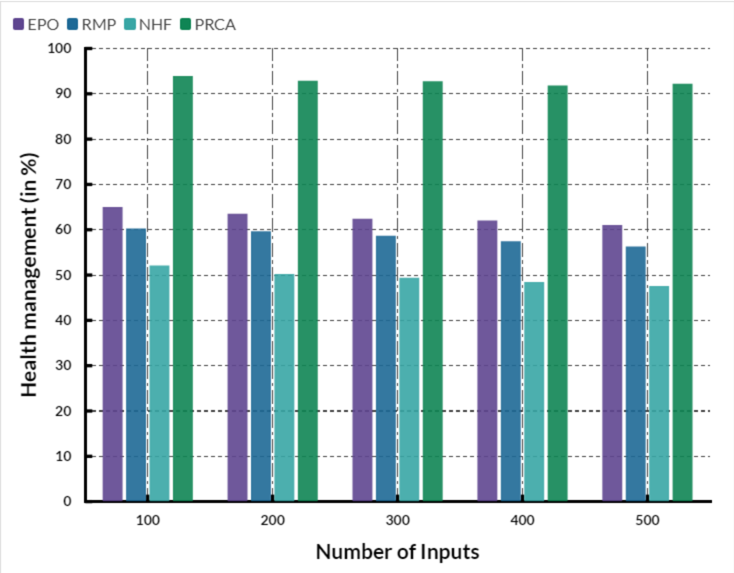

Fig 6: Comparison of Health management

The fig.6 shows the comparison of Health management. In a saturation point, the PRCA model achieved 92.77% of Health management. But the existing EPO reached 62.41%, RMP achieved 58.68% and NHF obtained 49.40% of Health management. The proposed model achieved better results while compared with the existing models

The child is healthy, develops normally, and is regularly monitored by the child's cardiologist. The connection of the umbilical cord of the duct - veins and fetal capillaries of the central system, the unborn child is closed during the first and second hours of life, in some cases it takes more time, or the venous flow is maintained. Therefore, if after an acceptable period of time, the anomalies of the heart structure do not disappear, they are considered as disadvantages and treatment depending on the effect on the function of heart diseases.

4. Conclusion

A cardiac arrest is a very common occurrence in a heart born after a cesarean section. This surgery is performed only in severe cases, saving the life of the newborn and his mother. This natural delivery process disturbs and runs an autonomous existence of the baby outside the abdominal organs. Nature has provided a child with a lot of work and this adaptation is going to be restructured, which is the natural process of birth. Artificially stimulating life mechanisms is the operative way to get the body in a stressed state and carry out activities. A vital cycle falls from the process - light, first breath and cry, broken when the fluids expand in the circulation. Morphology, behavior, including cardiovascular, speaks for itself in the presence of serious deviations from the average, because there is no hope for a successful outcome of childbirth in a natural way, vaginal birth, in a way that is much more dangerous for children than surgical delivery.

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