Egyptian Journal of Forensic Sciences (2016) xxx, xxx–xxx

HOSTED BY

ELSEVIER

Contents lists available at ScienceDirect

Egyptian Journal of Forensic Sciences

journal homepage: http://www.journals.elsevier.com/egyptian-journal-of-forensic-sciences

Perinatal asphyxia and medical professional liability: A case series

Andrea Verzeletti *, **Anna Leide**, **Francesco De Ferrari**

Medical and Surgical Specialties, Radiological Sciences and Public Health Department, University of Brescia, Brescia, Italy

Received 28 September 2015; revised 13 March 2016; accepted 21 March 2016

KEYWORDS

Medical malpractice;
Perinatal asphyxia;
Causal relationship

Abstract In the context of medical professional liability, obstetrics is one of the most involved medical specialties because the unfavorable outcome of a pregnancy is difficult to accept for parents, who tend to reduce it to inappropriate care that occurred during pregnancy or birth. 32 cases of perinatal asphyxia were evaluated by the Institute of Forensic Medicine in Brescia during the period between 1999 and 2014 (13 in Civil Court and 19 in Penal Court). 9 out of the 32 pregnancies were twins, so the considerations were carried out on a total of 41 fetuses/newborns. Profiles of inadequacy were identified in 66% of cases (85% of the cases evaluated in Civil Court; 53% of the cases evaluated in Penal Court). The existence of a causal relationship between the medical conduct and the onset of asphyxia was recognized in 79% of civil cases and in 38% of penal cases. There is a "greater rigor" in the verification of causal relationship and malpractice profiles in penal cases compared to civil ones: this is in harmony with the most recent Italian Court decisions, characterized by compelling suspect's protection in the presence of a reasonable doubt in criminal matters and by victim's protection in civil ones.

1. Introduction

In the context of medical professional liability, obstetrics is one of the most involved because the unfavorable outcome of a pregnancy is difficult to accept for parents, who often claim medical deficiencies during pregnancy or birth.

One of the most relevant conditions is perinatal asphyxia, a pathological condition that can occur before, during or immediately after the birth. In perinatal asphyxia there is a decrease in the oxygen content in fetal blood, caused by a not sufficient supply through the placenta before or during birth, or, after birth, by an alteration of the adaptation mechanisms to extrauterine life, such as the beginning of breathing, which may not correctly start.[1] The incidence of perinatal asphyxia is variable: the lower one in Scandinavian countries (about 5–1000 live birth), while in the underdeveloped countries it's 20–30 times higher.[2] Birth asphyxia is one of the recognized causes of perinatal mortality and childhood disability: a percentage between 20% and 50% of the asphyxiated infants dies in the perinatal period; 25% of the newborns will develop

* Corresponding author at: Università degli Studi di Brescia, Piazzale Spedali Civili 1, 25123 Brescia, Italy. Tel.: +39 030 3995480; fax: +39 030 3995839.
E-mail address: andrea.verzeletti@unibs.it (A. Verzeletti).
Peer review under responsibility of The International Association of Law and Forensic Sciences (IALFS).

http://dx.doi.org/10.1016/j.ejfs.2016.03.004

serious neurological problems, such as hypoxic-ischemic encephalopathy, cerebral palsy, mental retardation, learning disorders and epilepsy.[3] The mechanisms that determine perinatal asphyxia can be acute or chronic and can origin from the mother, from fetal adnexa (umbilical cord, placenta) or from the fetus/newborn. Regarding the mother, the cause is an insufficient oxygen supply to the fetus through the placental circulation. These events can occur during pregnancy or during labor because of maternal blood pressure changes or diseases lowering maternal blood oxygenation, or because of uterine contractions occurring outside labor, that reduce oxygenation through the umbilical vessels and depress fetus' cardiovascular and nervous system. If uterine adnexa are involved, the asphyxial event is connected to an interruption of umbilical circulation (because of a compression of the umbilical cord), or it can be caused by an alteration of placental gas exchange, as in the case of placenta previa, placental insufficiency or placental abruption. If the asphyxial mechanism originates from the fetus/newborn, the most frequent cause of asphyxia is his inability to breathe immediately after the birth and to put in place the mechanisms of neonatal adaptation: this can be the result of respiratory center depression caused by an excessive administration to the mother of analgesic drugs, or it can be the direct consequence of pathology of the fetus/newborn. The main risk factors for perinatal asphyxia are diabetes mellitus, high blood pressure, pre-eclampsia, second and third trimester hemorrhages, infections, poly-oligohydramnios, preterm birth, multiple pregnancy, drugs or toxic substance administration, intrauterine growth restriction. One of the most important target organs of perinatal asphyxia is the brain: there can be cerebral edema and hemorrhages, that can lead to an elevation of intracranial pressure, to alterations in cerebral blood flow and in regulatory mechanisms of the brain district, where there can be an irreversible cellular damage, up to hypoxic-ischemic encephalopathy.[4] There are three forms of hypoxic-ischemic encephalopathy: mild, moderate and severe.[5] Newborns who have the *mild* form (clinically characterized by increased irritability, normal muscle tone or mild hypotonia without seizures) generally have a normal psychomotorial development. Newborns who have the *moderate* form of encephalopathy (clinically characterized by lethargy, hypotonia, diminished spontaneous body movements, diminished reflexes with or without associated seizures) have a 20% probability to develop a severe brain disability. Newborns who have the *severe* form of encephalopathy (coma, flaccid muscle tone, tetraplegia, absence of primitive reflexes, seizures, need for mechanical ventilation) have a high probability of death or, if they survive, to develop a severe encephalopathy.[6] The prevention of perinatal asphyxia is essentially based on the identification of risk factors which are present before and during pregnancy, on careful controls during gestation and on an accurate and timely assistance during labor and to the baby immediately after birth. Before and during childbirth, prevention is based on cardiotocography (CTG), which considers the variability of the fetal heart rate and can give important information about the presence of fetal distress, conditioning also the approach to childbirth.[7] If there are signs or parameters allowing to detect asphyxia, the first measure is cesarean section; natural childbirth, in fact, could lead to a worsening of fetal distress, and it should be limited to cases in an advanced stage of labor.

2. Methods

32 cases of perinatal asphyxia were evaluated by the Institute of Forensic Medicine in Brescia, Italy, during the period 1999–2014: 13 cases in Civil Court and 19 in Penal Court. 9 out of the 32 pregnancies were twins (3 dealt in Civil Court and 6 in Penal Court), so the considerations were carried out on a total of 41 fetuses/newborns (16 in Civil Court and 25 in Penal Court). All cases were evaluated in association with the specialist obstetrician. According to Italian law civil field refers to the duty to repair the economic consequences of the damage; in penal field physician can be pursued by a crime committed during his work. These two fields are independent of each other: a physician can be pursed for the one or the other or both, according to the patient's will.

3. Results

The different maternal risk factors and the alarm signals whose presence correlates with a higher probability of an asphyxial episode before, during and after labor were considered (Table 1).

In 37% of cases, the delivery took place in a natural way, while in the remaining 63% a cesarean section was done. The distribution of Apgar score in the cases is shown in Table 2.

The cardiotocographic monitoring was performed in 63% of cases; in 65% of cases in which the monitoring was carried out, it was altered because of: the absence of fetal heart rate, decreasing variability, reduced fetal active movements, late decelerations (Table 3).

Ultrasound was performed in 38% of cases. In 17% of cases in which this examination was carried out no pathological findings were detected; in 83% of cases, ultrasound showed alterations, such as the absence of fetal heart rate, oligohydramnios or polyhydramnios, increased resistance of umbilical artery, areas of placental abruption, placenta previa, placental insufficiency, diffuse brain damage, intrauterine growth retardation (IUGR); only in one case, finally, the alteration detected by ultrasound examination was not specified (Table 4).

Table 1 Maternal risk factors and alarm signals.

Twin pregnancy	28%
Vaginal bleeding	22%
Premature rupture of membrane	19%
Placental abruption	19%
Preterm delivery risk	16%
High blood pressure/Preeclampsia	13%
Meconium-stained amniotic fluid	9%
Diabetes mellitus	6%

Table 2 Distribution of Apgar score.

Score	I minute (%)	V minute (%)	X minute (%)
8–10	10	42	60
4–7	50	32	20
⩽3	40	26	20

Please cite this article in press as: Verzeletti A et al. Perinatal asphyxia and medical professional liability: A case series, *Egypt J Forensic Sci* (2016), http://dx.doi.org/10.1016/j.ejfs.2016.03.004