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BIRTH TRAUMA – OBSTETRIC VIEW **PORODNA TRAUMA – OPSTETRIČKI POGLED**

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*Rad posvećujem svom velikom i najdražem učitelju,
predanom opstetričaru i humanisti – prof. dr. Henriku Bosneru!*
*This work is dedicated to a great and dear teacher of mine,
a devoted obstetrician and humanist – prof.dr. Henrik Bosner!*

Original paper

Key words: birth trauma, vaginal delivery, operative deliveries, perinatal care, professional responsibility

SUMMARY. Birth trauma still remains an unavoidable and very actual obstetric issue. Nobody in delivery rooms can be completely protected from this obstetric complication. The focused meaning of the term that will be discussed here represents only physical injuries to the fetus / newborn and the mother. Those birth injuries usually happen as a consequence of an extreme intrapartal mechanical forces acting directly to bony and soft connective tissues of fetal or maternal organisms. All obstetric interventions are at some degree risky and there are no absolutely accurate solutions. Although birth traumas are most often connected with vaginal deliveries, children delivered by cesarean section are not totally protected from those injuries. The incidence of some birth traumas did not change significantly during time, while some other forms of injuries appear more rarely. There are several classifications of birth traumas as well as their main causes, but a new basic classification into objective and subjective causes of intrapartal injuries is very important from both the obstetrical and medico-legal points of view. The causes could be defined as *objective*, if they are commonly associated with an increased risk of fetal and maternal injuries, if the injuries are usually more frequent or almost always result from those specific delivery situations, and if they are independent or modestly dependent of obstetrician's experience. All intrapartal unfortunate events associated with rare and prenatally undetected diseases or pathological fetal conditions that are directly attributable to development of injuries despite correctly performed obstetric interventions, are also included in the same group of causes. *Subjective causes* of birth injuries most often involve birth injury incidents as consequence of incorrect, negligent and superficial obstetric procedures in otherwise low-risk clinical situations. Birth injuries can be mild and transitory with a good outcome, but also tragic and devastating events with lethal consequences. Apart from perinatal significance, which comes from its influence on peripartal mortality and morbidity, birth trauma is very important from *medico-legal aspects*. Medico-legal and financial consequences are important to those children, their parents, medical staff, and the whole society. That is why the effective primary and secondary prevention of birth injuries are needed unconditionally. Obstetrician's correct and timely decisions and measures can greatly reduce birth traumas and their serious consequences.

Izvorni rad

Ključne riječi: porodna trauma, vaginalni porod, operacijski porodi, perinatalna skrb, profesionalna odgovornost

SAŽETAK. Porodna trauma nije samo vječna i nezaobilazna opstetrička tema, ona je ostala aktualnom sve do današnjih dana. Nitko u rađaonicama nije »oslobođen« porodne traume, ali svatko od nas ima određenu percepciju ove opstetričke komplikacije. U najširem smislu ona, s jedne strane, obuhvaća fizičku / hipoksičnu traumatu fetusa odnosno novorođenčeta i fizičku / psihičku traumatu majke, povezanu s porodom. S druge strane, uže značenje ovog termina kojim se autori ovdje bave, podrazumjeva isključivo fizičke ozljede majke i novorođenog djeteta. Shodno tome, neposredan uzrok porodnim traumama je isključivo pretjerano djelovanje tlačnih ili vlačnih mehaničkih sila na meka ili koštana tkiva majčinog odnosno fetalnog organizma tijekom poroda. Premda se porodna trauma logično povezuje sa slučajevima vaginalnih poroda, novorođenčad porođena carskim rezom također nije pošteđena spomenutih ozljeda. Dok se učestalost nekih porodnih povreda nije bitnije mijenjala (npr. prijelom klavikule, pareza pleksus brahijalisa, kefalhematom, laceracije mekih česti porodnog kanala, ...), neke su se ozljede, na sreću, prrijedile (ruptura simfize, ruptura tentorija/falksa, ...). Ima više podjela porodnih trauma (npr. na maternalne i neonatalne, fizičke i psihičke, »tipične« i slučajne, ...) te se i njihovi uzroci mogu klasificirati na razne načine. Temeljna podjela na objektivne i subjektivne uzroke je važna s aspekta opstetričke i sudsko-medicinske prakse i pravne struke. Uzroci se mogu definirati kao *objektivni*, ako nose opće poznati povišeni rizik od nastanka traume, ako su u takvim završnicama poroda ozljede češće nego što je to uobičajeno ili ako su one gotovo neizbježne i ako ne ovise ili tek malo ovise o iskustvu i djelovanju opstetričara. U spomenutu skupinu uzroka spadaju i svi nesretni slučajevi povezani s rijetkim i neprepoznatim bolestima ili patološkim stanjima najčešće fetusa, koji izravno doprinose traumi i kod pravilno izvedenih opstetričkih postupaka. Takvi su uzročni čimbenici npr. relativna kefalopelvična disproporcija kod sužene zdjelice I. i II. stupnja ili makrosomije, sekundarna uterina inercija, zastoj ramena, izražena pretilost roditelja, rigidni meki dijelovi porodnog kanala, neke metaboličke, kromosomske ili tumorske bolesti fetusa, neke

fetalne malformacije i dr. Kategorija *subjektivnih uzroka* obuhvaća više akcidentalne slučajeve porodnih trauma, koji nastaju kao posljedica najčešće nestručnog, neopreznog ili površnog opstetričkog postupka u kliničkim situacijama bez povišenog rizika. Takve će traume češće izazvati neiskusni opstetričari i oni koji postupaju nepažljivo, nelogično, dekoncentrirano i koji se nepotrebno žure zbog navodnog nedostatka vremena. Porodne traume mogu biti blage i prolazne, a ishod izlječenje, ali one mogu biti i trajne i tragične, sa smrtnim ishodom ili invaliditetom. Posljedice medicinske, pravne i financijske prirode važne su za samo čedo, njihove roditelje, medicinske djelatnike, lokalnu zajednicu i cijelo društvo. Zato je neobično važna učinkovita *primarna i sekundarna prevencija* porođajnih trauma. Spomenutom cilju može doprinijeti iskusan neonatolog svojom brзом i točnom dijagnozom i primarnim zbrinjavanjem ozlijeđenog čeda, čime se sprječavaju sekundarna oštećenja. S druge strane, za neposredan oporavak i zdravlje roditelje izuzetno je važno brzo i pouzdano prepoznavanje ozljeda mekih česti porodnog kanala i njihova korektna kirurška reparacija. Osim perinatološkog (kliničkog) značaja zbog utjecaja na perinatalni mortalitet i morbiditet, porođna trauma je važna i sa *sudsko-medicinskog aspekta*, budući je i kod nas u Hrvatskoj sve češće predmet tužbi i odštetnih zahtjeva. Sve opstetričke intervencije nose određeni rizik i nema apsolutno sigurnih rješenja. Najmanji rizik od peripartalne ozljede nose apsolutno spontani vaginalni porod i elektivni carski rez. Dok carski rez samo smanjuje rizik za čedo, ali ga u potpunosti ne eliminira, perioroperacijski maternalni morbiditet i mortalitet rastu 3 – 8 puta u odnosu na spontani porod. Zato nas strah od porodnih ozljeda ne smije u praktičnom radu opteretiti više nego što je potrebno i biti uzrokom pretjeranom porastu carskog reza. Uvođenje reda u klasifikaciju porodnih trauma i njihovih uzroka s aspekta prakse, pojašnjenje mehanizama i specifičnih opstetričkih situacija koje bi bile odgovorne za njihov nastanak i prikaz opstetričkih smjernica za primarno i sekundarno zbrinjavanje nastalih ozljeda trebali bi pomoći u rješavanju sve brojnijih i ozbiljnih sudsko-medicinskih problema koji zaokupljaju pozornost i ometaju u radu opstetričare širom svijeta. Samo pravilnim, blagovremenim i odgovornim stručnim odlukama i postupcima opstetričari, istina, neće potpuno ukloniti porodne traume, ali će im značajno smanjiti broj i njihove štetne posljedice.

Introduction

Birth trauma was and still remains an unavoidable and very actual obstetric issue. Since it is also rather extensive issue, its more than complex obstetric aspect cannot be completely presented shortly. Thus, we'll emphasize only the basic and important facts about the definition of birth trauma, its pathogenetic mechanisms, risk factors, causes, classifications, incidence, clinical symptoms and diagnostic procedures, as well as treatment modalities, postpartum outcomes, medico-legal consequences and preventive measures.

The question is: who can be protected from birth trauma? Unfortunately, the answer is that nobody in the delivery rooms can be fully protected from this obstetric complication.¹ In spite of that fact, one can assume that each of us, professionals who deal with the relevant topic, has an unique perception of the birth trauma and its incidence based on personal experience. Nevertheless, the true definition is very simple and the actual incidence of the birth trauma can be obtained objectively only if there is a good will to register all birth traumas we are witnessing. In spite of the existing obligation to document relevant details regarding the course of delivery, including birth traumas, most often the cases of fetal injury are not published. Such practice is making risk reporting and counseling difficult.

Definitions and risk factors of birth injuries

Generally speaking, birth traumas could be defined as physical and hypoxic fetal/neonatal traumas and physical and psychical traumas of the mother sustained during delivery. On the other hand, the focused meaning of the term that will be discussed here represents only physical injuries to the fetus / newborn and the mother. Those birth injuries happen as a consequence of an ex-

treme intrapartal mechanical forces action, seldom of natural and mostly of iatrogenic origin, directly to bony and soft connective tissues of the mother and the fetus.² Pathogenetic mechanisms represent developing processes of birth traumas associated with some specific clinical circumstances and the mentioned excessive forces. As previously stated, there are no physical injuries without violent compression (with forceful uterine contractions, excessive pressure on the uterine fundus), excessive traction or distortion forces (during manual or instrumental extraction) to fetal or maternal tissues.³ At the same time, it has to be emphasized that almost each birth injury has its specific or characteristic elements of the pathogenetic mechanism.⁴

Risk factors should be presented as pathological conditions or diseases (macrosomia, abnormal maternal pelvis, previous shoulder dystocia, chronic placental insufficiency, preeclampsia, fetal malformations, etc.), which could provoke or facilitate birth trauma in the situations of commonly standardized perinatal care, with increased frequency. Similarly, some risky clinical situations without an existence of previous objective risk factors (protracted delivery, uterine inertia, vacuum-assisted delivery, overstimulation of uterine contractions, malrotation of fetal head, impacted fetal head, etc) could also result in birth injury.^{5,6} Its size and intensity mostly depend on obstetrician's education and skill. Those could be prevented by improved preparation for birth or better medical decisions during delivery. A continuous intensive and careful surveillance is certainly needed to intervene obstetrically correct and on time minimizing or even preventing birth injuries.

All obstetric interventions are at some degree risky and there are no absolutely accurate solutions. Normal, uneventful spontaneous vaginal delivery and elective cesarean section have minimal risks of peripartal injuries. Although birth traumas are most often connected

with vaginal deliveries, children delivered by cesarean section are not totally protected from those.⁷ The most frequent fetal injuries during the cesareans (1.1%) are skin lacerations (0.7%), cephalhematoma (0.2%), clavicle fracture (0.03%), skull fracture (0.02%), brachial plexus (0.02%) and facial nerve palsy (0.03%).^{7,8} The frequency varies with the indication for surgery as well as the duration of the skin incision-to-delivery interval and the type of uterine incision.⁸ In addition, perioperative maternal complications are 38 times greater than in vaginal deliveries, meaning the incidence of cesarean sections has to be put under control.

Causes and classifications of birth injuries

Causes of birth injuries represent those actions that directly cause injuries. However, there are several specific medical conditions that can provoke injuries with greater incidence. In such circumstances traumas could be avoided only by quick reaction of well skilled and trained medical staff with a dose of luck. Sometimes the risk factor can progress during the birthing process transforming to an actual cause of birth injury.

There are several classifications of birth traumas (for example: maternal and fetal or neonatal, physical and psychological, »typical« and accidental; according to injured body parts, organs and tissues) as well as their main causes. We would like to introduce new classification that could, hopefully, be established with time. Namely, the basic classification into objective and subjective causes of intraparturial injuries is important from both the obstetrical and medico-legal points of view.

The **objective causes** are those associated with an increased risk of fetal and maternal injuries. Also, if injuries are more frequent or result of specific delivery situations, and if they are independent or modestly dependent of obstetrician's experience they could be considered as objective ones (unavoidable). All intraparturial unfortunate events associated with rare and prenatally undetected diseases or pathological fetal conditions that are directly connected to injuries in spite of the correct obstetric interventions, are also included in the same group of causes. Such cases are, for example, those with relative cephalopelvic disproportion in cases of narrow maternal pelvis (of the first / second degree) or fetal macrosomia, shoulder dystocia, uterine inertia, extreme maternal weight, reduced elasticity of soft tissue of birth canal, some metabolic (*osteogenesis imperfecta*), chromosomal or tumor diseases of the fetus (*teratoma*), and some fetal malformations. Among all, shoulder dystocia is certainly one of the most controversial medical and forensic intraparturial emergencies.⁹ Depending on the definition, the incidence varies from 0.1% up to 2%.^{9,10} Two main causes are fetopelvic disproportion and malrotation of shoulders. Since it mostly occurs unpredictably and unexpectedly, obstetricians become aware of the consequences just at the moment of its existence.^{10–12} Apart from extremely difficult situations when

final outcome is hopeless regardless to performed obstetric procedure (primary or secondary *head and shoulder maneuvers*), during the attempt to relieve the shoulders, due to the inadequate interventions, distinctly heavy birth traumas occur.¹³ Occasionally they can be permanent. Therefore, we intercede that the court experts during their evaluation do not decide in advance and set the responsibility upon the obstetricians for the appearance of unpredictable shoulder dystocia. Instead, they should be evaluating the actual procedure in releasing the shoulder from the birth canal and the final outcome to the child's health.

Subjective causes of birth injuries most often involve birth injury incidents as a consequence of incorrect, negligent and superficial obstetric procedures in otherwise low-risk clinical situations. Inexperienced obstetricians, who act carelessly, illogically or in an unnecessary hurry without any justifiable reason, can cause those birth injuries much more frequently avoidable. Some examples of such injuries are fractures of normally structured long bones, spinal cord injury during breech delivery, fetal scalp / skull injury due to the incorrectly performed vacuum extraction,^{3,14} violent cervical dilatation, uterine rupture, etc.

The incidence of birth injuries greatly depends on a preciseness of definitions and diagnostic criteria used. Our education, practice and willingness to report objectively all the birth trauma cases into medical records are very important. Each birth injury has its own typical incidence. The incidence of some birth traumas such as *clavicular fracture, brachial plexus injury, cephalhematoma, cervical, vaginal and perineal lacerations* did not change significantly during time, while those like *symphyseal rupture* or *rupture of tentorium cerebelli / falx cerebri*, appear more rarely. Due to previously mentioned medical and paramedical reasons, reported incidences often differentiate among various medical institutions, countries and world regions. Generally, the incidence of birth traumas has been decreasing. Obstetricians most often underestimate the problem of birth trauma, especially if it results in neonatal injury, primarily since the incidence appears to be low.¹⁴ In addition, obstetricians do not treat newborns, thus they do not supervise the postnatal treatment and have no reverse information about the course of illness. Exceptions are those cases that result in patient's complaints and lawyer suits, when an obstetrician gets a chance to know all the obstetric details relevant to the particular case and its definitive outcome. To avoid these unwanted situations and to achieve a higher level of professional education for all active participants, we strongly recommend a very close cooperation between obstetricians / perinatologists, neonatologists, pediatricians, surgeons, and other specialists that are involved in treatment of injured neonates. It could be concluded that the incidence of birth trauma should be reduced rather by prevention and careful obstetric work than unprofessional and negligent paper work.

Results

At our Department there were 2853 deliveries in 2006. Among them, 255 (8.9%) were cesarean deliveries. Out of total of 2598 vaginal deliveries, there were 2548 (89.3%) spontaneous ones. In 50 cases (1.75%) vacuum extraction has been applied.

Among 85 (3.3%) birth injuries to soft tissues of birth canal, 45 were vaginal lacerations (1.7% of all vaginal deliveries), 33 were cervical lacerations (1.3%), and the remaining 5 cases (0.2%) were perineal ruptures of the grades 3 and 4.

Out of total of 2881 live born children, there were 151 suffering from birth injuries to fetal tissues (5.2%). The most frequent injuries were cephalhematomas (58 cases or 2.0% of vaginal deliveries), clavicular fractures (same number of cases), and 35 cases of brachial plexus injury (1.2%). In the vacuum extraction group the incidence of cephalhematomas were 3, fractures of clavicle 4 whilst brachial plexus injuries 10 times greater than in the group of spontaneous vaginal deliveries. Such results are certainly significant and they correlate with those obtained in various published studies.^{3,14} There were neither intracranial nor symphyseal injuries within studied groups.

Birth weights of almost one third of newborns with clavicular fracture were 4000g or more, and 43.1% of them were with birth weights of 3800g or more. In the same group, brachial plexus injury was associated in nearly one third (32.8%) of clavicular fractures. The lowest birth weight in the observed group of children was 2880 g. In 22 cases (37.9%) of clavicular fracture the diagnosis was made only clinically, without radiographic verification, what should not be recommended, particularly due to the medico-legal reasons.

In the group of 35 newborns with brachial plexus injury, 48.6% of them had birth weight 4000 g or more, and even 68.6% had birth weights of 3800 g or higher. The incidence of brachial plexus paresis in newborns weighing less than 3800 g, considering term infants (≥ 37 weeks) as a target population for these injuries, was calculated to be 4.81 per 1000 live births. It is not surprising, that relative risks for newborns weighing more than 3800 g and 4000 g were 8.0 and 9.6 respectively. The lowest birth weight in the observed group was 3070 g. According to the medical records all these deliveries were uneventful, without delay. It is worthy to mention that more than 50% of newborns with brachial plexus injury had ipsilateral fracture of clavicle. However, there were only 10 among all the newborns suffering brachial plexus injury that were treated by physical therapy whereas the other 25 cases did not require therapy, they recovered quickly and spontaneously. It could be concluded that a majority of brachial plexus injuries is commonly mild and transitory.

Nevertheless, many authors reported that a policy of elective cesarean sections for fetal macrosomia (with or without diabetes) is neither effective in reducing the

incidence of injuries nor medically and economically sound.^{15,16}

Clinical and medico-legal aspects of birth injuries

Clinical symptoms depend on the type, intensity and the grade of the birth injury.^{1,3} Most of the clinical manifestations are local physical changes. Discontinuity of the skin and underlying tissue, bones, blood vessels and nerves associated with consequent bleeding, local swelling and compression of the adjacent vital structures can be found. The results of the described lesions could be reduced or abandoned vital functions like blood supply, regional enervation, instability of distal parts of extremities, etc. Diagnostic methods involve clinical evaluation and observation, ultrasound and radiographic examination and different laboratory tests.¹⁷

How to manage birth injuries after making a diagnosis? Almost all the consequences could be reduced by professional and careful treatment. Although more than several measures and procedures have been included, the best medical treatments most often are conservative and expectant measures: bed rest, bandage, wet compresses, immobilization, physical therapy, electro stimulation, symptomatic and preventive treatments (with ice, analgesics, antibiotics), and continuous and very close clinical surveillance.^{3,17} Such management is quite efficient in cases of cephalhematoma, clavicle fracture, brachial plexus paresis and uncomplicated skull fractures without dislocations. However, there is certainly room for several various surgical interventions (sutures, incision, excision, aspiration, evacuation, drainage, fixation, and more complex manipulations) as well as the replacement therapy like blood transfusion.

Birth injuries can be mild and transitory with a good outcome, but also tragic and devastating events, drastically altering the course of the child's life forever. If the birth trauma has been misdiagnosed and the treatment inadequate or delayed, the clinical course of birth trauma could be worse and its final outcome may become more difficult than it should be. The consequences could also be lethal.

Apart from perinatal significance, which comes from its influence on perinatal mortality and morbidity, birth trauma is very important from *medico-legal aspects*, and now even in Croatia an increased number of lawsuits and complaints against obstetricians claiming for indemnity became more common than it was the case only few years ago. That is the additional reason, why it is very important to put all the relevant data and medical observations in medical records. Based on such complete and adequate medical record, entire obstetric event could be reconstructed chronologically. Such unwanted medico-legal situation could be additionally complicated if specialized lawyers attorneys (like birth injury lawyer, shoulder dystocia lawyer, brachial plexus palsy lawyer, etc) are involved in the case. If obstetri-

cian is found liable, hospital is obligated to make a financial compensation. The situation is quite clear, more bills – more significant financial problems for individuals and institutions.

Furthermore, there is an additional problem, often not clearly seen by professionals. Namely, an additional negative appearance as a result of the birth trauma stories and increasing number of unpleasant lawsuits, results in growing fear among obstetricians making them overreact with consequently increased number of unnecessary elective and emergency cesarean sections with well known difficulties for mother's health.

Medico-legal and financial consequences are important to affected children, their parents, medical staff, local community, and the whole society. That is why the effective primary and secondary prevention of birth injuries are imperatively needed.^{3,18} The primary prevention includes avoidance of complicated obstetric situations in the presence of objective risk factors, which could induce the birth injury at the final stage of labor. The secondary prevention represents the election and the use of the most favourable obstetric manipulations and their professional performance in already complicated and urgent obstetric situations.

For all reasons described, the issue of birth traumas should be a part of obstetricians' basic education since its successful management includes special training, team-work and individual approach.¹⁸ In addition, an experienced neonatologist could improve these intentions by a fast and accurate diagnosis, and professional management of injured newborns.

Conclusion

It can be simply concluded that obstetrician's correct and timely decisions and expert manipulations cannot eliminate the appearance of birth injuries, but certainly can greatly reduce their number and serious consequences.

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