

Long term results of neurosurgical treatment of subdural fluid collections in infants after purulent meningitis

Odległe wyniki leczenia neurochirurgicznego wylewów podtwardówkowych u niemowląt po przebyłym ropnym zapaleniu opon mózgowo-rdzeniowych

Augustyn Folwaczny¹, Andrzej Życiński², Jan Baron³, Piotr Bażowski², Józef Dzielicki⁴, Tomasz Legaszewski⁵, Wojciech Pieniążek¹, Anna Kuroś-Wikło⁶, Stanisław Furgał¹, Edyta Machura¹, Franciszek Halkiewicz¹, Bogusław Mazurek⁷

¹ Chair and Department of Paediatrics in Zabrze

² Chair and Clinic of Neurosurgery

³ Chair and Department of Radiology and Nuclear Medicine

⁴ Chair and Department of Paediatric's Surgery in Zabrze

⁵ First Chair and Department of Radiology in Zabrze

⁶ Chair and Clinic of Anesthesiology and Intensive Care

⁷ Department of Paediatric Cardiology

Medical University of Silesia, Katowice

ABSTRACT

Despite efficient vaccination schedules, great progress in intensive care and potent antimicrobial therapies the bacterial meningitis is still life-threatening condition. **Aim of the study:** Assessment of remote neurosurgical – treatment results of subdural fluid collections in infants after bacterial meningitis. **Material:** 40 infants (12 girls and 28 boys) aged 3 weeks to 10 month of life. All the children had a history of purulent meningitis in: 14 (35%) with concomitant septicemia – and meningo- encephalitis in 7 (17,5%). In all patients subdural fluid collections were diagnosed. Multiple decompressing subdural punctures were performed in 27 (67,5%) of patients. Bilateral burr-hole trepanation was performed in two stages in 28 (70%) of patients, unilateral in 10 (25%) and craniotomy in 2 (5%). **Results:** After 13-31 year observations, the results of neurosurgical treatment are as follows: normal psychomotor development in 33 (82,5%) of children, mental retardation in 3 (7,5%), serious psychomotor retardation in 2 (5%), epilepsy in (3) 7,5%, partial hearing loss in (6) 15%, unilateral visual impairment in 3 (7,5%). Two of patients completed university education, two bachelor's degree, four are university students, five completed college, seven attend college, eight completed vocational school, five attended secondary school. The remaining five disabled patients completed or attend individual education. **Conclusions:** Long term results of neurosurgical treatment in our patients, who are the most severe cases treated in region inhabited by 6,5 mln population, seem to be satisfactory.

Key words: bacterial meningitis, subdural fluid collections, burr hole trepanation, craniotomy.

STRESZCZENIE

Bakteryjne zapalenia opon mózgowo-rdzeniowych mimo wprowadzenia skutecznych programów szczepień ochronnych, dużych postępów w intensywnej terapii, szerokiej możliwości zastosowania odpowiedniej antybiotykoterapii, nadal pozostają poważnym, zagrażającym życiu schorzeniem. **Cel pracy:** Ocena odległych wyników leczenia neurochirurgicznego wylewów podtwardówkowych u niemowląt po przebyłym ropnym zapaleniu opon mózgowo-rdzeniowych. **Materiał i metoda:** 40 niemowląt (12 dziewczynek i 28 chłopców) w wieku od 3 tygodni do 10 miesiąca życia. Wszystkie dzieci przebyły zapalenie opon mózgowo-rdzeniowych, w tym 14 (35%) z towarzyszącą posocznicą oraz 7 (17,5%) zapalenie opon mózgowo-rdzeniowych i mózgu. U wszystkich niemowląt stwierdzono wylewy podtwardówkowe. Wielokrotne nakłucia odbarczające podtwardówkowe w oddziałach macierzystych województwa śląskiego i opolskiego wykonywano u 27 (67,5%) dzieci. Trepanację otworkową obustronną wykonywano dwuetapowo u 28 (70%) dzieci, jednostronną u 10 (25%) dzieci. Kraniotomię wykonano u 2 dzieci. **Wyniki:** Odległe wyniki leczenia po obserwacji 13 – 31-letniej przedstawiają się następująco: 33 (82,5%) dzieci wykazuje prawidłowy rozwój psychomotoryczny, troje (7,5%) dzieci – upośledzenie umysłowe, 2(5%) dzieci upośledzenie psychomotoryczne dużego stopnia, u trojga (7,5%) dzieci stwierdzono padaczkę, u sześciorga (15%) niedosłuch, u trojga (7,5%) niedowidzenie jednostronne. Dwoje dzieci ukończyło szkołę wyższą, dwoje studium pomaturalne, czworo uczęszcza do szkoły wyższej, pięcioro ukończyło szkołę średnią, siedmioro uczęszcza do szkoły średniej, ośmioro ukończyło szkołę zawodową, pięcioro uczęszcza do gimnazjum, pozostałe pięcioro z upośledzeniem umysłowym ukończyło lub kontynuuje nauczanie indywidualne. **Wniosek:** Mimo że materiał obejmował najcięższe przypadki leczone na terenie obszaru zamieszkanego przez około 6,5 mln ludności, odległy wynik postępowania terapeutycznego wydaje się dobry.

Słowa kluczowe: zapalenia opon mózgowo-rdzeniowych, wylewy podtwardówkowe, trepanacje otworkowe, kraniotomia

Despite efficient vaccination schedules, great progress in intensive care and potent antimicrobial therapies, bacterial meningitis (BM) is still life-threatening condition [1-5].

In Europe the incidence of the disease ranges from 2 – 6 cases per 100000 [1]. Onset of BM occurs most often in the first two years of life [1]. Mortality in meningococcal BM in children reaches 1 – 4% [1], and according to literature, the data is markedly higher when meningococcal sepsis occurs.

In pneumococcal BM the mortality ranges from 6 to 20% with higher incidence of complications and neurological deficits [1]. 15% out of 482 children presented by Peltola and al. died [6]. Presently, in Europe, as a result of efficient vaccination program, BM caused by *Haemophilus influenzae* B occurs mainly in non-vaccinees [1]. Mortality within this group amounts to 3%. In preterms remote consequences occur in up to 50% of patients [7]. Higher incidence of neurological complications and deaths is observed in malnourished children with body mass deficit [8]. Immediate empirical antimicrobial therapy and stabilization of vital functions is particularly important in severe course of the disease. During treatment patient should be under neurological, laryngologic and ophthalmologic control and transfontanellar US or CT/NMR should be performed [1,2,5,9]. Neuroradiology reveals that subdural fluid collections occur in 30-40 % of BM [10]. Only 10-20% of cases demonstrate increased intracranial pressure [11]. Long-standing experience revealed that fluid collections caused by BM or trauma require more often an operative treatment due to adhesions and capsule formation [11,12].

AIM OF THE STUDY

The aim was to assess remote results of neurosurgical treatment of fluid collections in infants after purulent meningitis.

MATERIAL

40 infants (12 girls and 28 boys) aged 3 weeks to 10 months of life were treated in neurological unit at I Chair and Department of Pediatrics, Silesian Medical Academy in Zabrze between 1979 and 1997. All of them had a history of purulent meningitis with concomitant septicaemia in 14 (35%) and encephalitis in 7 (17,5%). Children were treated in Pediatric Departments of Silesian Medical Academy, County and City Hospitals mainly in Silesian and Opole Voivodships.

In 22 (55%) cases initial clinical status of children was severe or extremely severe. Only two children (5%) were previously cured in Zabrze. Etiology of BM is presented in table I.

Table I. Etiology of meningitis in assessed patients

Ethiology	Number of patients	%
<i>Neisseria meningitidis</i>	11	27,5
<i>Haemophilus influenzae</i>	5	12,5
<i>Salmonella</i>	3	7,5
<i>Streptococcus pneumoniae</i>	2	5
<i>Staphylococcus aureus</i>	1	2,5
<i>Staphylococcus epidermidis</i>	1	2,5
Unknown	17	42,5

Recurrent seizures were observed in 8 (20%) of children, with unilateral localization in two.

In one boy (C.K., file number 2016/88) after surviving meningoencephalitis he had at the age of 6 months, a right – sided hemiplegia occurred. During surgery about 190 ml of bloody fluid was evacuated under high pressure. The brain pulsated well, and it had a tendency to expand. Right flaccid paresis stopped completely several months after on operation. Presently, the physically and mentally fit young man is a 3-rd year university student.

Multiple decompressing subdural punctures in maternal wards were performed in 27 (67,5%) children. In 15 (37,5%) cerebrospinal fluid cytosis, assessed during the first puncture, ranged from uncountable mass to 16/3, protein concentration ranged from 3379 mg/dl to 200 mg/dl. In remaining 12 (30%) children cerebrospinal fluid was bloody or xanthochromic with numerous to uncountable lysed erythrocytes in smear and protein concentrations ranged from 5550 mg% to 264 mg/dl.

Cerebral CT scans were performed in 37 (92,5%) children, with concomitant US examination in seven, and MRI in one patient. In two children only US examination (5%) was performed, and in one, in 1979, cerebral angiography (2,5%).

Bilateral burr hole trepanation was performed in two stages in 28 (70%) children, and unilateral in 10 (25%). Craniotomy was done in two patients. During 68 trepanations between 20 – 200 ml (mean 62 ml) of fluid was evacuated.

One child, a boy (M.T., file 688/80), who at the age of five months went down with BM (*salmonella typhi murium B*) accompanied with DIC. During his stay at Intensive Care Unit multiple subdural punctures were performed. Subsequently, wide left – side craniotomy was done with evacuation of purulent 3-4cm fluid collection. At the second stage of surgery 40 ml of non-purulent fluid

was evacuated from the region above right hemisphere. At present patient is 29 years old (height 188 cm, body mass 79 kg – fig 1a,b,c,d,e). Unfortunately, CT scans from 1980

had disappeared. He has completed Special Primary School for mentally retarded. He walks and speaks satisfactorily, can read and count, helps with housework.

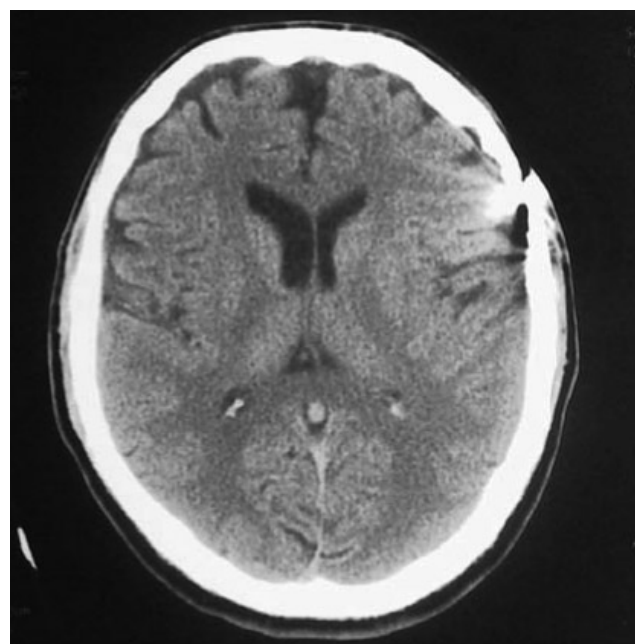
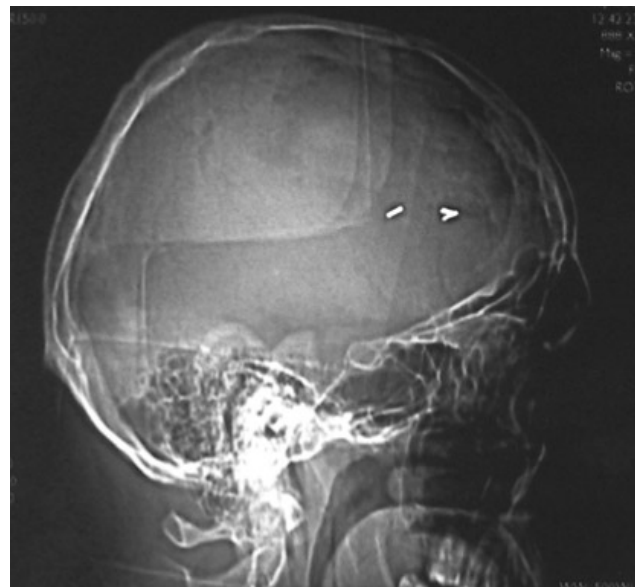
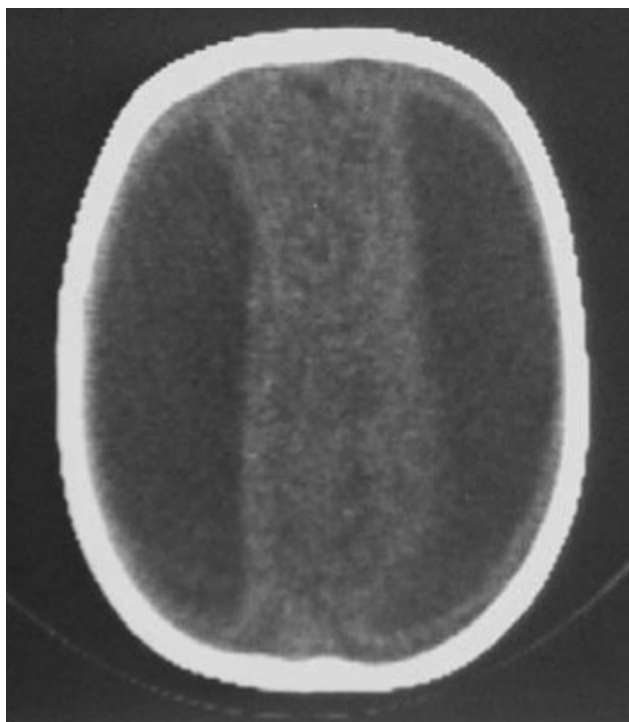


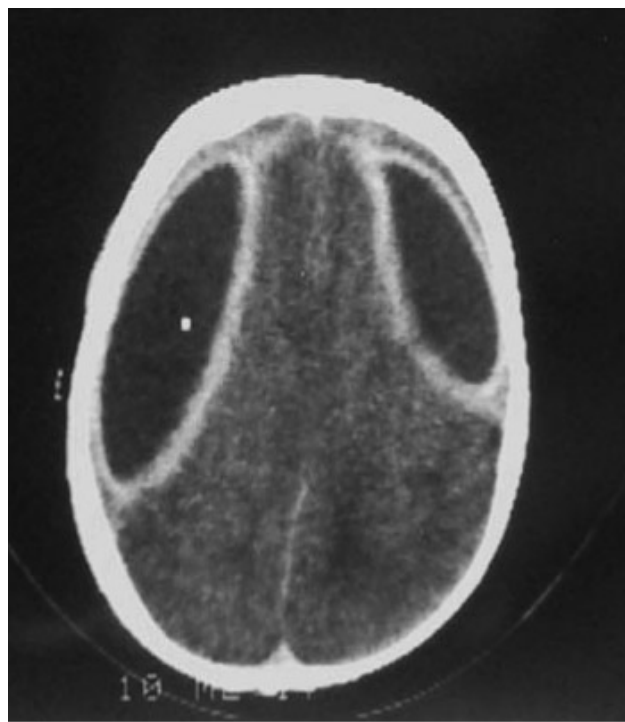
Fig.1 Silhouette of patient M.T. aged 26 (meningitis at 5 mths) – a,b; profile picture with craniotomy scar -c; up-to date CT scan with staples and moderate enlarging of subdural space in the frontal region – d,e.

In another child (I.M., file 845/89), in whom purulent pneumococcal meningitis was diagnosed at the age of three weeks, multiple decompressing punctures and 0,9% saline lavages of left side were performed. He was operated on twice, at the age of eight and sixteen months, with the evacuation of 150 ml and 80 ml of encapsulated purulent fluid subsequently. In this patient at the age of

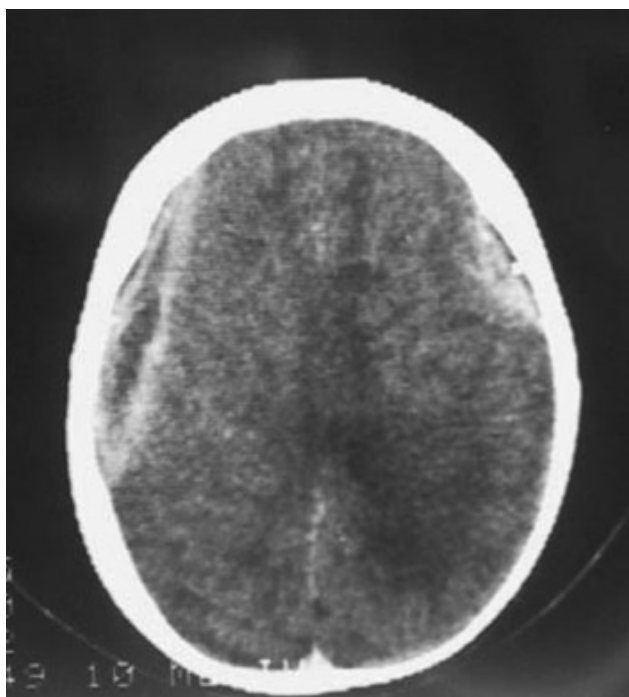
seven months 150 ml of xanthochromic fluid was evacuated from the right subdural space. Fig 2a presents cerebral CT scan at the age of five months, and 2d- 13,5 months later. At present the patient is 21 years old. He walks and speaks quite well. He completed individual, home education. Because of epilepsy, he is chronically treated with valproate.



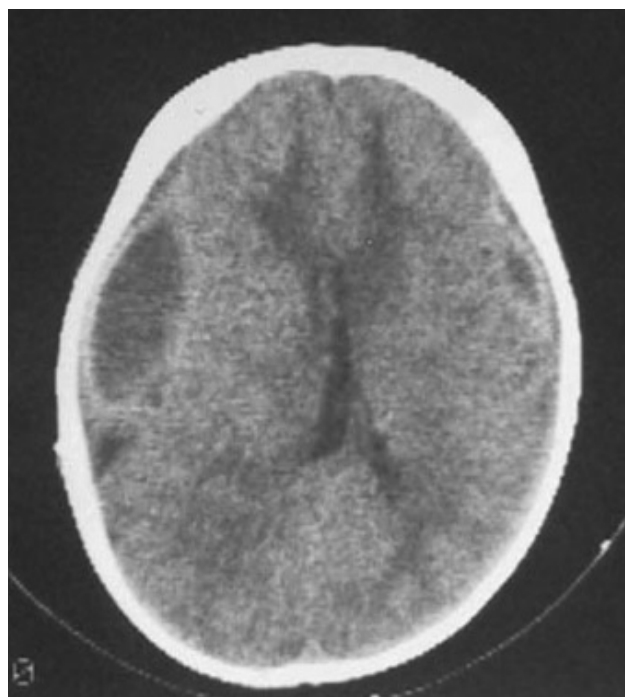
a. 14.07.89



b. 01.09.89



c. 27.4.90

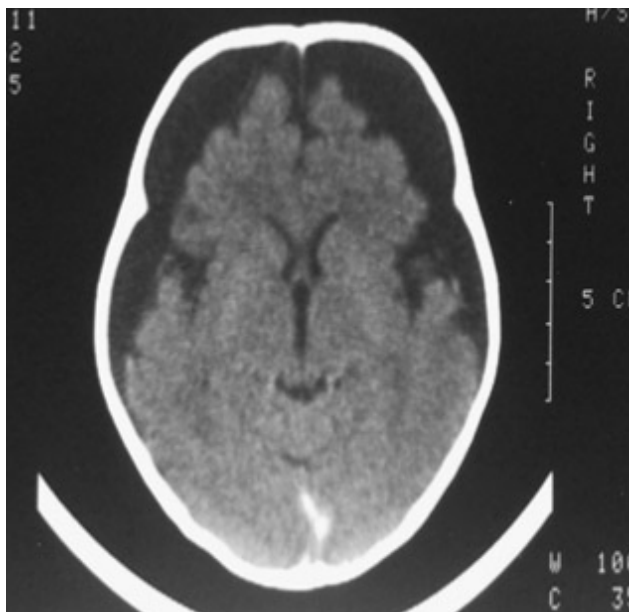


d. 27.08.90

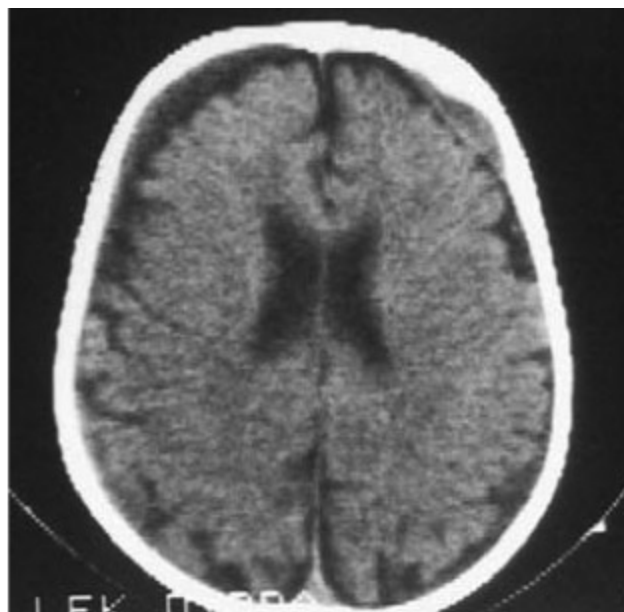
Fig.2. Patient I.M. at the age of 5 months with large fluid collections at the frontal, occipital and parietal region – a; 1,5 month later a marked reduction of fluid collections with contrast enhancement of , what can be interpreted as pericerebral abscesses – b; next CT scan performed eight months later revealed regression of the size of abscesses with residual changes – c; four months later CT revealed fluid collections at frontal and right occipital regions – d.

In a child K.P. (file number 98/97), a preterm with birth weight of 1650 g, in the third week of life staphylococcal sepsis (*S. epidermidis*) and meningitis were diagnosed. In fifth month of life a 100 ml of xanthochromic fluid was evacuated from right subdural space (hygrohaematoma). In eleventh month of life 20 ml of bloody fluid was evacuated from the same region. Because of increasing internal hydrocephaly ventriculo – atrial shunt modo Pudenz 12 mm was implanted in thirteenth month of life. At present, the boy is motorically fit, has IQ below average, bilateral hypoacusis. He has individual training program at school.

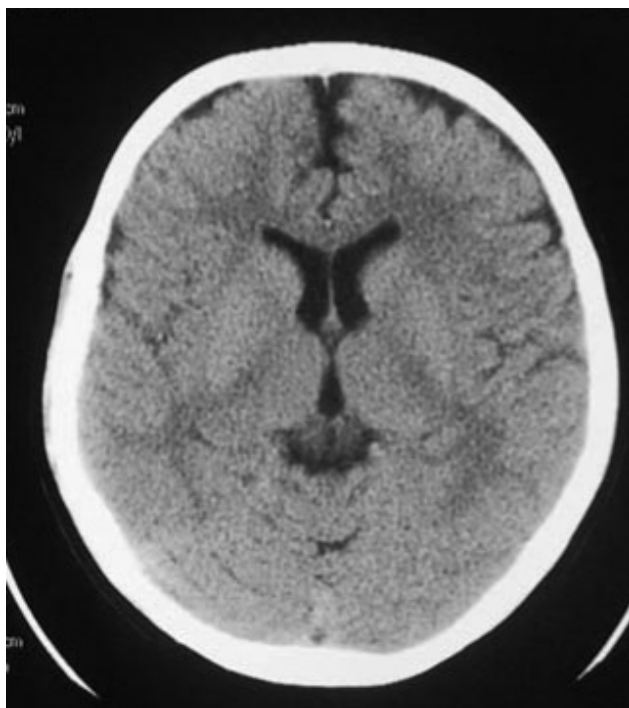
One child (B.P., file No 1857/92), a boy who at the age of 6 months suffered from bacterial severe encephalo – meningitis (*Haemophilus Influenzae*) with cardiorespiratory failure symptoms. After 2 months a subdural fluid collection was located over right hemisphere and consisting of 40 ml hematoma and 60 ml hygroma. At the age of 10 months, collection of 200 ml bloody and xanthochromic fluid was evacuated from left subdural space (fig.3a CT before neurosurgical treatment, fig. 3B control CT scan after 6,5 months, fig. 3 c,d after ten years). At present, the boy attends secondary school with good progress. He has



a. 6.11.92



b. 28.05.93



c. 18.10.2002



d. 18.10.2002

Fig. 3. Patient B.P. At the age of 8 months with bilateral pericerebral hygro – hematomas - before neurosurgical treatment – a; control CT scan after 6,5 months with residual subdural hematoma at the region of left frontal lobe – b; control CT scan ten years after – c,d.

no pathological findings in neurological examination.

In one girl (U.Ż., file No 114/88), a preterm (birth weight 1450g), at the 8 month of age meningococcal meningitis was diagnosed. At the age of 12 months a capsulated, right sided three-layer, 20 + 15 + 20 ml subdural xanthochromic fluid collection was evacuated. Recently she has completed technical college.

Remote results of treatment after 13-31 -year follow-up are presented in tab. II.

Table II. Results of treatment in 13-31 years follow-up

Remote treatment results	Number of patients	%
Normal psychomotor development	33	82,5
Mental retardation	3	7,5
Severe psychomotor retardation	2	5
Epilepsy	3	7,5
Partial hearing loss	6	15
Unilateral visual impairment	3	7,5

In patients with mental retardation (M.T., file No 688/80 and I.M., file No 845/89) salmonellosis, and pneumococcal BM was diagnosed, and preterm patient (K.P., file No 98/97) with *Staphylococcus epidermidis* neonatal bacterial meningitidis. Patients with severe psychomotor retardation (G.P., file No 1977/93, and P.P., file No 1867/94) had unknown or staphylococcal (*S. aureus*) etiology subsequently. In 3 patients with secondary epilepsy, etiology in one case of BM remained unknown, and in 2 children pneumococcal infection was diagnosed. In 6 patients with hearing impairment meningococcal etiology was established, in 4, salmonellosis in 1, and in 1 patient etiology remained unknown [18, 21-23]. In 5 cases hearing impairment was bilateral, and in 1 – unilateral. In the group of 40 operated on patients two (5%) died from non-neurological causes.

DISCUSSION

Long – term complications of bacterial meningitis are: secondary epilepsy, mental retardation, cerebral palsy, analyzer function disorders, lesions of cranial nerves, sensual impairment, characteropathies, headaches and educational problems [2,3,5,12,13]. Neurological consequences are significantly more often in case of severe course of the disease in acute phase [14]. Major subdural fluid collections are accompanied by recurrent fever, vomiting, focal symptoms and seizures. If the subdural fluid collection is expansive or is bigger in size, subdural puncture and drainage is necessary [9,12,15]. In case of subdural empyemas treatment is always operative, sometimes with several days' -of drainage and local antibiotics [16-19]. 27 (67,5%) out of our 40 patients after BM had multiple decompressing subdural punctures because of life threatening condition. Bilateral burr-hole trepanation was performed in two stages in 28 (70%) children, unilateral in 10 (25%) and craniotomy in 2 (5%).

On the basis of 13–31-year observation in 33 patients

normal psychomotor development was found. Education of our patients is presented in table III. In the group of 461 children according to de Louvois and al. [20], after BM – 7,8 % of patients attend special education school. The risk of neurological complications ranges from 10 – >30% [18, 21, 22]. Despite outstanding progress in treatment in recent years, this percentage did not decrease markedly [16, 22]. Early administration of dexamethasone in *Haemophilus influenzae* B and pneumococcal infections improved final treatment result, but in others is doubtful [17].

Table III. Education in 13-31years follow-up

Education	Number of patients	%
University - graduated	2	5
University - student	4	10
Post-college licency - graduated	2	5
College - graduated	5	12,5
College - student	7	17,5
Vocational school - graduated	8	20
Gymnasium - attending	5	12,5
Individual education program	5	12,5

Immediately after the acute phase of BM 30 – 40% of patients present neurological symptoms. Many disorders concerning cranial nerves, hearing, vision, motor activity and behavior resolve within a few weeks or months [24-26].

Serious intelligence impairment (IQ < 70) appear in 5 – 10% of patients [26,27], in next 5% IQ ranges from 70 – 80, and in 10% minor school problems are observed.

In our study group 5 (12,5%) patients are mentally retarded. Recurrent seizures were observed in 8 (20%) of our patients. In 889 patients with BM reported from pediatric centers in France [28] seizures were observed in 13,6% of patients. Epilepsy occurs in 4-7 % of children after BM [24,26,27].

It occurs usually within the first five years, but it could occur even 15 years after BM. In our patients epilepsy occurred in 3 (7,5%) cases. Hearing impairment was diagnosed in 6 (15%) of our patients. According to literature reports hearing loss (>25 dB) occurs in 7 – 10% [2,7,18,23], and in pneumococcal infections even about 19% [16]. According to the most actual research of Peltola and al. [29] administration of dexamethasone or glycerol does not protect from hearing impairment in BM. Unilateral eyesight impairment was observed in 3 (7,5%) of patients. Other authors report 2 – 4% incidence [3,30,31].

Van Calenbergh and al. [31] applied long-term external drainage of subdural hemorrhages in 31 infants. This clinically effective therapy was burdened with low complication rate. Vinchon and al. [32] in 29 patients recruited from the area inhabited by population of 4 million, with subdural fluid collections after BM treated neurosurgically and observed for 26 years had found normal psychomotor development in 69%, severe complications in 10% and epi-

lepsy in 39%. Total resolving of giant subdural empyemas was achieved in 10 months old girl after needle punctures and 0,9% saline lavage [4]. Baechli and al. [33] described 8 month old boy with epidural empyema of posterior cave, in whom hyperbaric therapy with 100% oxygen was admin-

nistered. This method is usually used as additional therapy in patients with cerebral empyemas, tumors and infarctions [34]. Summarizing, remote results of treatment administered in our patients are good, despite assessing the most serious cases recruited from 6,5 million population area.

REFERENCES

- [1] Adam R., Schroten H.: Eitrige Meningitis. *Monatsschr Kinderheilk* 2006; 154: 469-482.
- [2] Baraff L.J., Lee S.I., Schriger D.L.: Outcomes of bacterial meningitis of children: a metaanalysis. *Pediatr Infect Dis J* 1993; 12: 389-394.
- [3] Dodge P.R.: Neurological sequelae of acute bacterial meningitis. *Pediatr Ann* 1994; 23: 101-106.
- [4] Folwaczny A., Bromirska J., Życiński A. et al.: Olbrzymie ropniaki podtwardówkowe u dziewczynki 10-miesięcznej jako powikłanie biegunki salmonellowej. *Ann Acad Med Siles* 1991; suppl 12: 181-185.
- [5] Gołębiowska M., Czachorowska M.: Bacterial meningitidis of children. *Klin Ped* 2003; 11: 227-234.
- [6] Peltola H., Roine J., Fernandez J. et al.: Adjuvant glycerol and or dexamethasone to improve the outcomes of childhood bacterial meningitis: a prospective, randomized, double-blind, placebo-controlled trial. *Clin Infect Dis* 2007; 45: 1277-1286
- [7] Grimwood K., Anderson P., Anderson V. et al.: Twelve year outcomes following bacterial meningitis further evidence for persisting effects. *Arch Dis Child* 2000; 83: 111-116.
- [8] Roine J., Weisstaub G., Peltola H. et al.: Influence of malnutrition on the course of childhood bacterial meningitis. *Ped Infectious Dis J* 2010; 29: 122 - 125
- [9] Grimwood K., Anderson V.A., Bond L. et al.: Adverse outcomes of bacterial meningitides in school-age survivors. *Pediatrics* 1995; 95: 646-656.
- [10] Halket S., de Louvois J., Holdt D.E. et al.: Long term follow up after meningitis in infancy: behaviour of teenagers. *Arch Dis Child* 2003; 88: 395-398.
- [11] Heath P. J., Nik Yusoff N.N., Baker C. J.: Neonatal meningitis. *Arch Dis Child Fetal Neonatal Ed*, 2003; 88: F 173-F178.
- [12] Hobstova J.: Hnisave meningitidy v detskem veku. 1999; Edice Alma Mater, Galen, Univerzita Karlova v Praze.
- [13] Józwiak S.: Postępy w diagnostyce i leczeniu chorób układu nerwowego u dzieci. *Wyd. Bi Folium Lublin* 2009, t. 10: 61-74
- [14] Jeffrey D., Snedeker M.D., Sheldon L.: Subdural effusion and its relationship with neurologic sequelae of bacterial meningitidis in infancy: a prospective study. *Pediatrics* 1990; 86(2): 163-170.
- [15] Józwiak S., Michałowicz R.: Neurologia dziecięca w praktyce. Ostre i przewlekłe choroby infekcyjne układu nerwowego. *BiFolium Lublin* 2001: 316-364.
- [16] Kaarensen P.J., Flaegstad T.: Prognostic factors in childhood bacterial meningitis. *Acta Paediatr* 1995; 84: 873-878.
- [17] Banerjee A.D., Pandey P., Devi B.J. et al.: Pediatric supratentorial subdural empyemas: a retrospective analysis of 65 cases. *Pediatr Neurosurg* 2009; 45: 11-18
- [18] Koomen J., Grobbee D.E., Roord J.J. et al.: Hearing loss at school age in survivors of bacterial meningitis: assessment, incidence and prediction. *Pediatrics* 2003; 112: 1049-1053.
- [19] Van Hoeck K.J., Mahieu L.M., Vaerenberg K.J., et al.: A retrospective epidemiological study of bacterial meningitis in an urban area in Belgium. *Eur J Pediatr* 1997; 156: 288-291.
- [20] de Louvois J., Halket S., Harvey D.: Effect of meningitis in infancy on school-leaving examination results. *Arch Dis Child* 2007; 92: 959-962
- [21] Kornelisse R.F., Westerbeck C.M., Spoor A.B. et al.: Pneumococcal meningitis in children: prognostic indicators and outcome. *Clin Infect Dis* 1995; 21: 1390-1397.
- [22] Philips B.: Towards evidence based medicine for paediatricians. *Arch Dis Child* 2004; 89: 81-82.
- [23] Pomeroy S.L., Holmes S.J., Dodge P.R. et al.: Seizures and other neurologic sequelae of bacterial meningitis in children. *N Engl J Med*. 1990; 323: 1651-1657.
- [24] Saez-Lorens X., Cracken G.H. Jr.: Bacterial meningitis in children. *Lancet* 2003; 361: 2139-2148.
- [25] Schmitt B.: Folgen der bakteriellen Meningitis. *Monatsschr Kinderheilk* 2004; 152 (4): 382-390.
- [26] Schroten H.: Diagnostik und Therapie der bakteriellen Meningitis. *Monatsschr Kinderheilk* 2004; 152: 382-390.
- [27] Stevens J.P., Eames M., Kent A et al.: Long term outcome of neonatal meningitis. *Arch Dis Chil Fetal Neonatal Ed* 2003; 88: 179-184.
- [28] Dubos F., De la Rocque F., Levy C. et al.: Sensitivity of the bacterial meningitis score in 889 children with bacterial meningitis. *J Pediatr* 2008; 152: 378-382
- [29] Peltola H., Roine J., Fernandez J. et al.: Hearing impairment in childhood bacterial meningitis is little relieved by dexamethasone or glycerol. *Pediatrics* 2010; 125: e1-e8
- [30] Thun-Hohenstein L., Schmitt B., Steinlin H. et al.: Cortical visual impairment following bacterial meningitis: magnetic resonance imaging and visual evoked potential findings in two cases. *Eur J Pediatr* 1992; 151: 779-782.
- [31] Van Calenbergh F., Bleyen J., Lagae L., et al.: Long-term external drainage for subdural collections in infants. *Child's Nerv Syst* 2000; 16: 429-432.
- [32] Vinchon M., Joriot S., Jissendi-Tchofo P, et al.: Postmeningitis subdural fluid collection in infants: changing pattern and indications for surgery. *J Neurosurg* (6 Suppl Pediatrics) 2006; 104: 383-387.
- [33] Baechli H., Schmutz J., Mayr J.M.: Hyperbaric oxygen therapy (HBO) for the treatment of an epidural abscess in the posterior fossa in an 8 month old infant. *Pediatr Neurosurg* 2008; 44(3): 239-242
- [34] Fischer B.R., Speckman J., Greiner C. et al.: Hyperbaric oxygen in neurosurgery. *Acta Neurochir* 2009; 151: 415-418

Correspondence:

Augustyn Folwaczny, I Katedra i Klinika Pediatrii w Zabrze ŚUM w Katowicach, 41- 800 Zabrze, ul. 3-go Maja 13 – 15
e-mail: wpieniazek@interia.pl