Нозокомиальные менингиты в нейрореанимации

НИИ нейрохирургии Н.Н. Бурденко

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Особенности развития внутрибольничных менингитов у пациентов отделения нейрореанимации

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Features of Nosocomial Meningitis in Patients of a Neurosurgical Critical Care Unit

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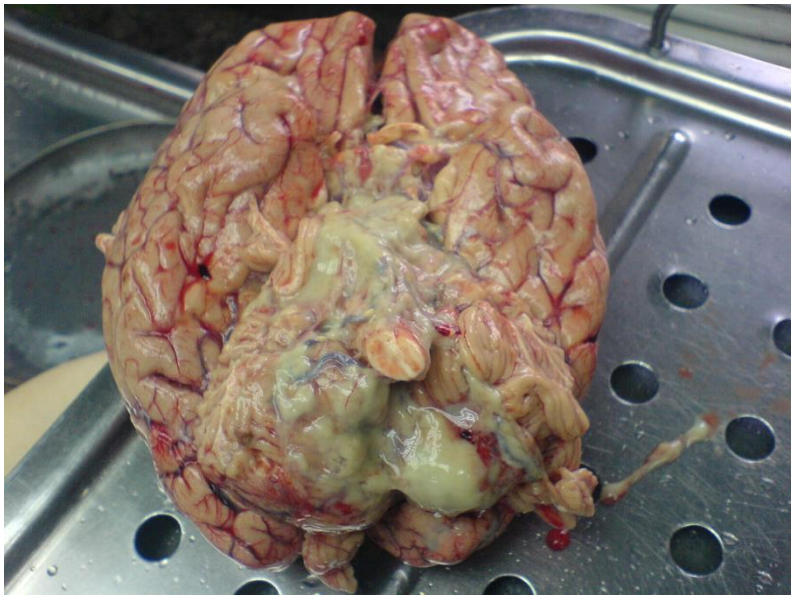
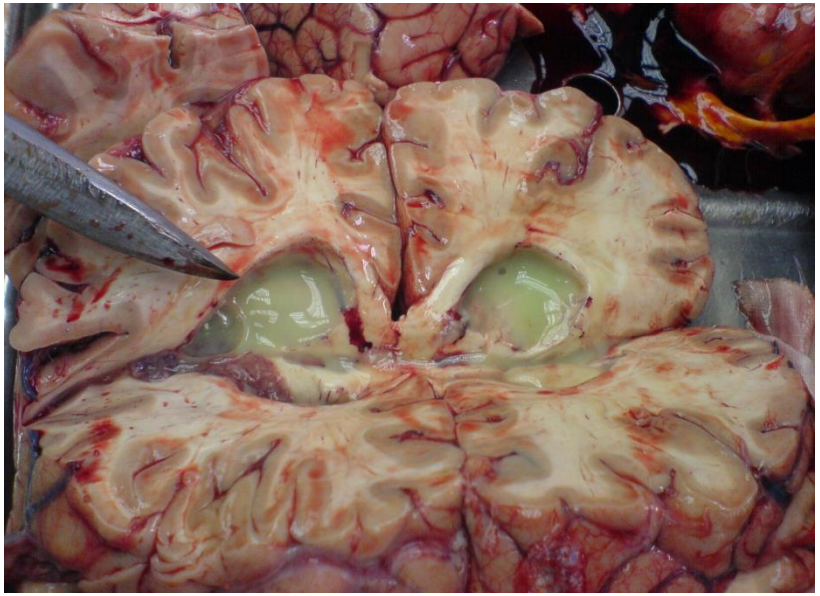
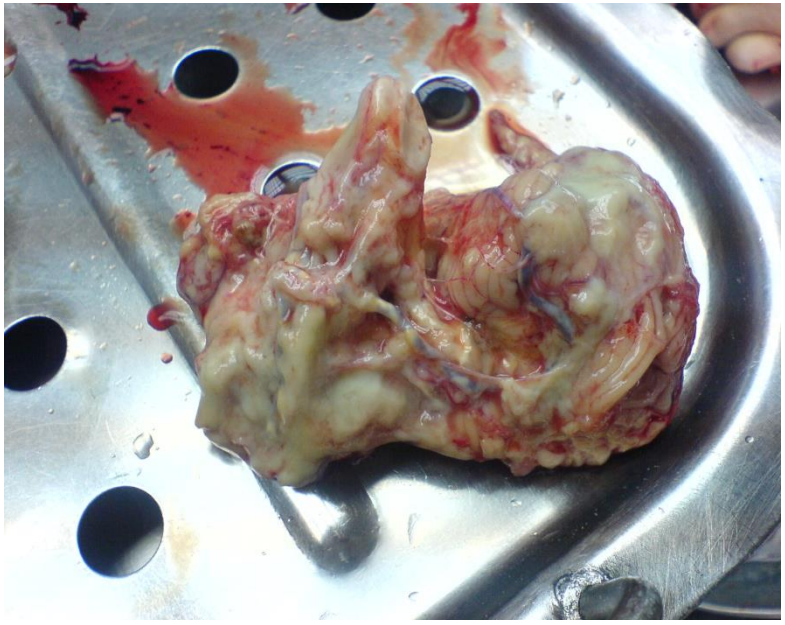
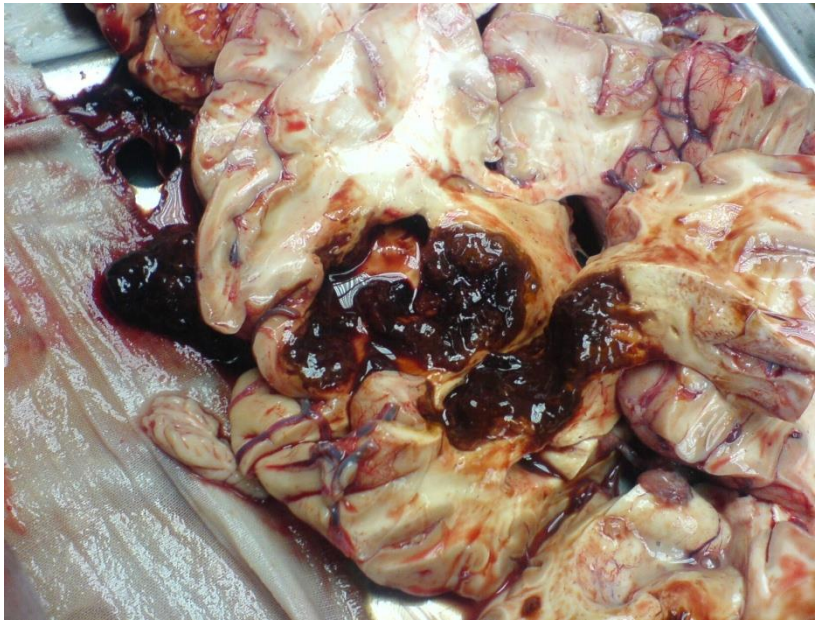
Менингит

Воспаление менингеальных оболочек головного и спинного мозга, сопровождающееся общей интоксикацией, менингеальным синдромом, повышением внутричерепного давления и изменением состава спино-мозговой жидкости









Этиология менингитов

Бактериальные гнойные менингиты

Neisseria meningitidis (грамотрицательные кокки)

Streptococcus pneumoniae, Haemophilus influenzae

Менингиты после нейрохирургического вмешательства – *Acinetobacter baumannii Staphylococcus spp., Klebsiella spp., Candida spp*.

Бактериальные серозные менингиты

Mycobacterium tuberculosis

Borrelia, Mycoplasma pneumoniae

Вирусные серозные менингиты- энцефалиты

Энтеровирусы, Герпесвирусы, Цитомегаловирусы, вирус эпидемического паротита, кори, краснухи, клещевого энцефалита

Инфекции в области нейрохирургического вмешательства *

Поверхностные

- разреза кожи
- слизистых оболочек или костной ткани черепа
- нагноение раны

Глубокие

- менингит,
- вентрикулит
- менингоэнцефалит

CDC/NHSN Surveillance HAI criteria, 2011

Клинический Диагноз

- **Уровень глюкозы ликвора ниже 2,2 ммоль/л (или< 40-50% от уровня глюкозы крови при гипергликемии)**
- **Нейтрофильный цитоз ликвора > 50 в 1 мкл**
- **Высев патогена из ликвора**
- **Повышение уровня белка в ликворе > 220 мг/дл**

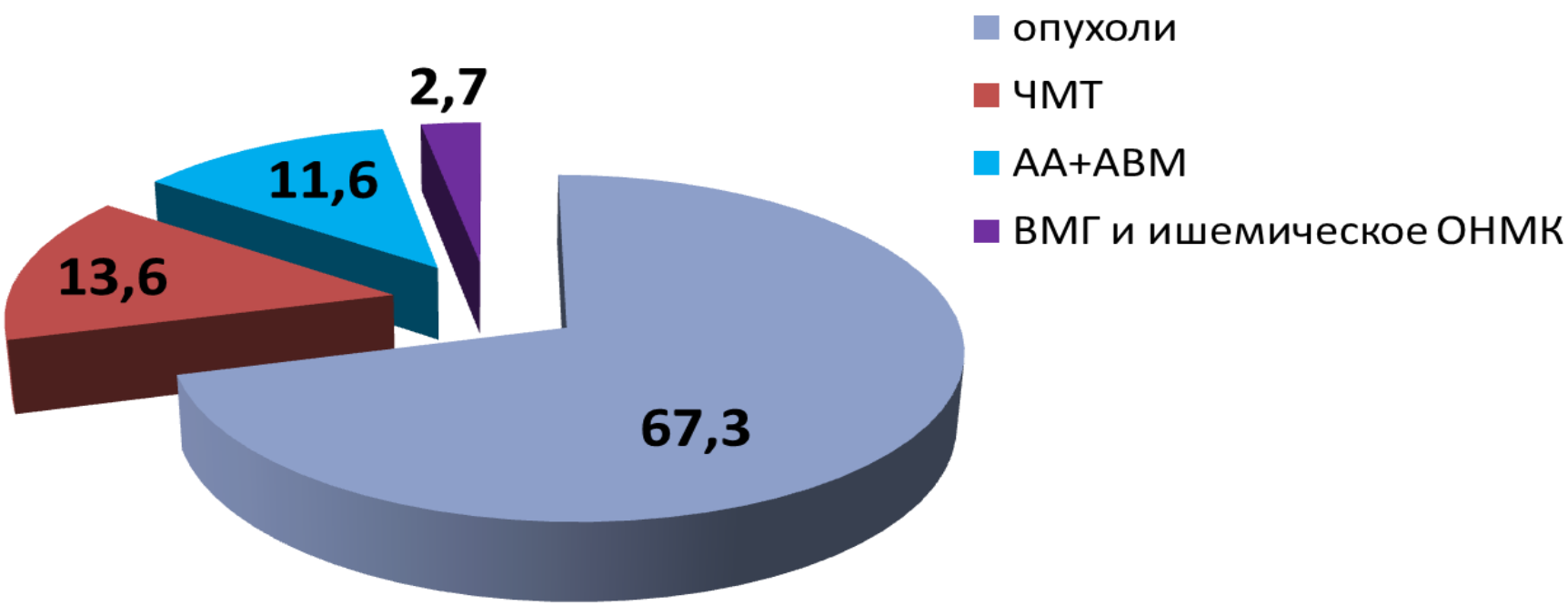
- Визуализация микробов в ликворе при окраске по Граму
- Повышение лактата ликвора ≥4.0 mmol/L,
- Признаки системной воспалительной реакции (SIRS-синдром)
- Развитие отрицательной динамики неврологического статуса
- Гипонатриемия

Результаты проспективного наблюдения в НИИ нейрохирургии

- Октябрь 2010 - октябрь 2015 гг **(Σ через реанимацию 16 404 б-ных**)
- Систематизирована информация о **2174 больном**
- **180 пациентам** поставлен диагноз «**менингит**»
- Частота развития нозокомиального менингита у пациентов ОРИТ составила

  8,3% ±0,8 (ДИ 95% 6,7-9,9)
- Летальность в группе больных с менингитами составила **29% ±3,4**

Распределение пациентов по характеру н/х патологии



Статистически значимых различий в группах заболевших и не заболевших менингитом нет ($p < 0,05$)

Неврологические проявления менингит

Наличие отрицательной динамики неврологического статуса - 80 больных (47,0%)

Угнетение сознания до сопора-оглушения – 43 (53,7%)

Кома – 12 (15%)

Судороги – 7 (8,7%)

Психомоторное возбуждение – 13 (15%)

Менингеальная симптоматика – 24 (30%)

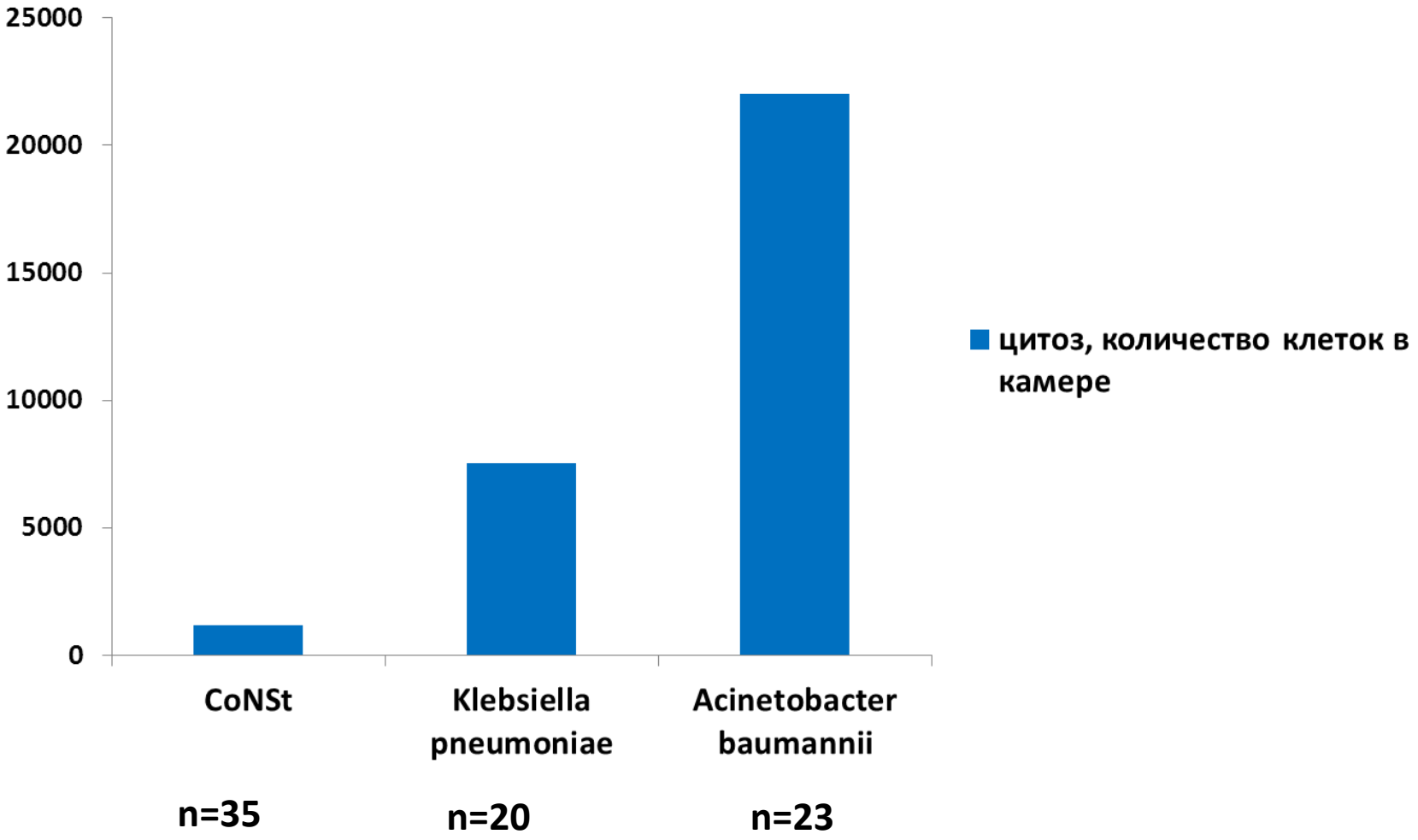
Проявления менингита
Гипонатриемия 85 пациентов (47%)

- min Na 105 ммоль/л
- При Грам (–) 43,5%
- При Грам (+) 23,5%
- По данным литературы частота гипонатриеми 7-35%.

Особенности менингитов в зависимости от этиологии

Патоген	Число б-ных, n	Летальность %	НВД %	ИОХВ, ликворея %	дней от операции до менингита мода	инфекции другой локализации %	Койко-дни, n
Klebsiella pneumoniae	20,0	45,0	65,0	75,0	14,0	85,0	38,0
Acinetobacter baumannii	23,0	43,3	69,5	87,0	12,0	78,2	42,0
Staphylococcus CN	35,0	20,0	91,4	28,5	6,0	49,0	21,0

Показатель цитоза а ликворе



Возможности использования молекулярных методов при диагностике менингитов

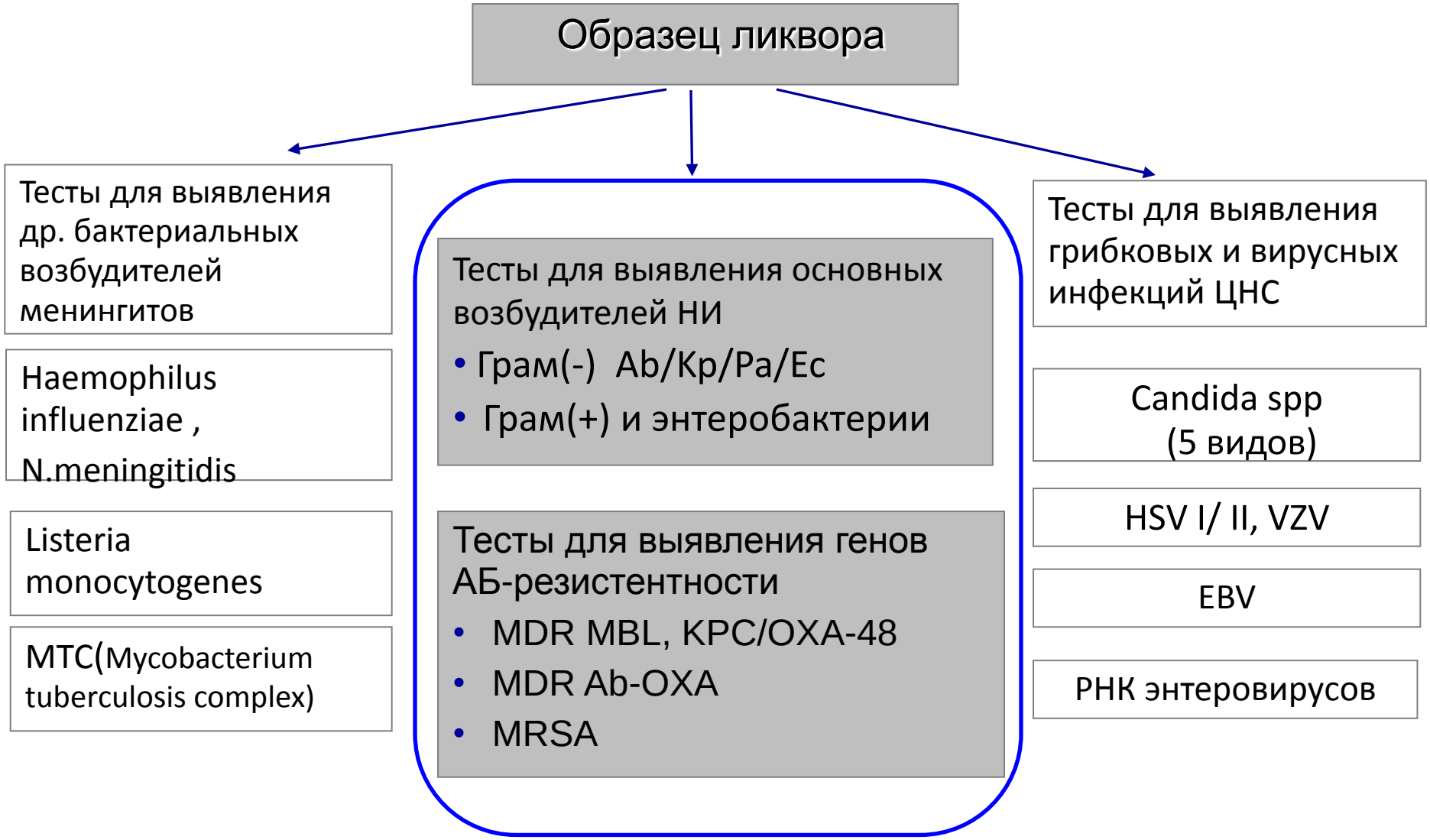
ПЦР в режиме реального времени (ПЦР-РВ) – быстрый метод выявления различных бактериальных, вирусных и грибковых патогенов

Преимущества

- ПЦР-РВ, позволяет в течение 3,5 ч выявлять ДНК основных бактериальных возбудителей менингитов

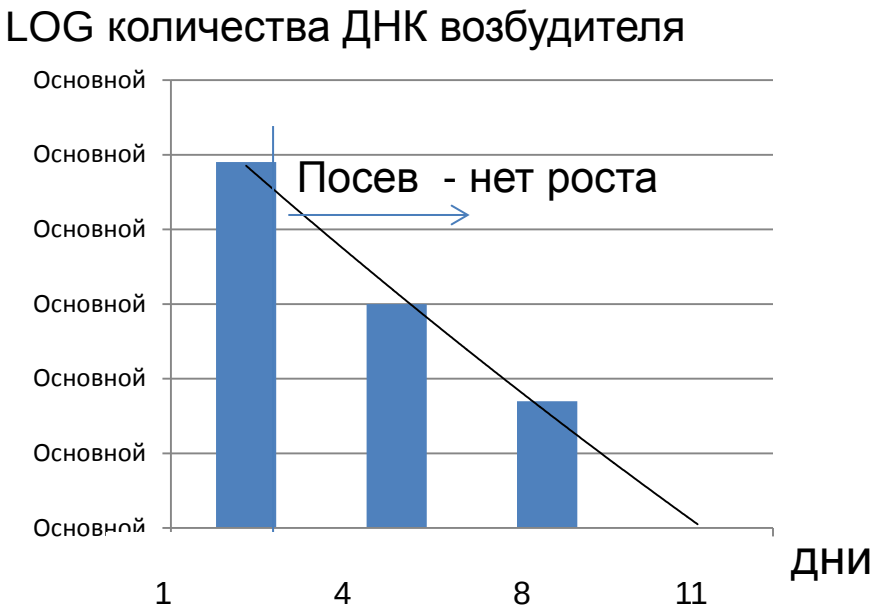
- ПЦР-РВ выявляет ГЕНЫ антибиотикорезистентности - адекватная антибиотикотерапия

Алгоритм ПЦР-исследования

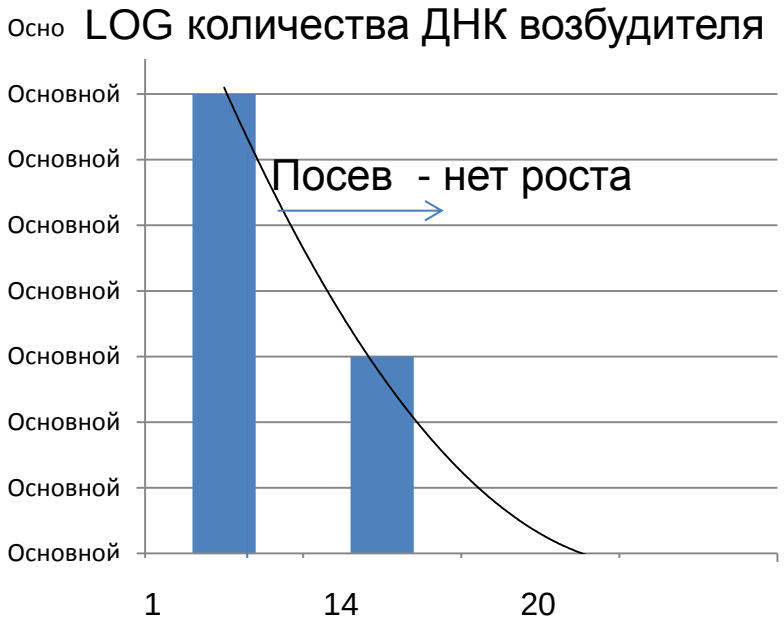


Возможность оценки эффективности лечения методом ПЦР-РВ: пока недостаточно данных

Пациент С. ,
инф. *Streptococcus spp*,
успешное лечение



Пациентка К. ,
инф. *Acinetobacter baumannii*,
успешное лечение



- При успешном лечении через 3-4 дня резко снижается количество ДНК возбудителя – на 2-3 порядка.
- Однако минимальное количество ДНК (100-10^3 геномов/мл) может сохраняться более 10 дней

ФАКТОРЫ РИСКА
нозокомиального менигита

Основные факторы риска (анализ литературы)

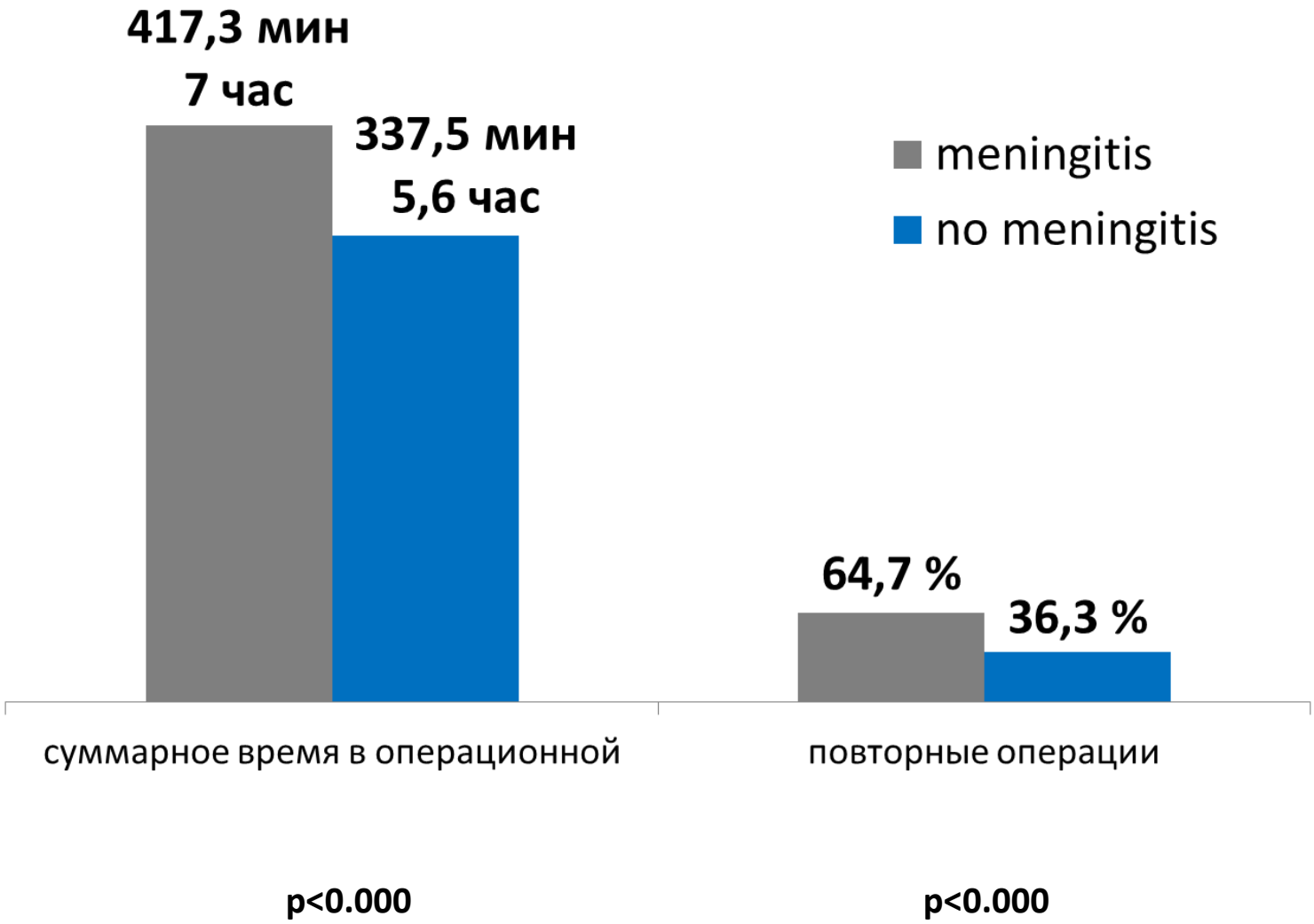
- Люмбальная пункция
- Внутрижелудочковое кровоизлияние
- Раневая ликворея
- Длительность н/х операции
- Наличие НВД и продолжительность дренирования
- Наличие ВПШ, датчика ВЧД, факт повторного вмешательства, проникающие ранения черепа
- Проведение антибиотикопрофилактики

Van Aken M. O. et al. Cerebrospinal fluid leakage during transsphenoidal surgery: postoperative external lumbar drainage reduces the risk for meningitis //Pituitary. – 2004. – Т. 7. – №. 2. – С. 89-93.

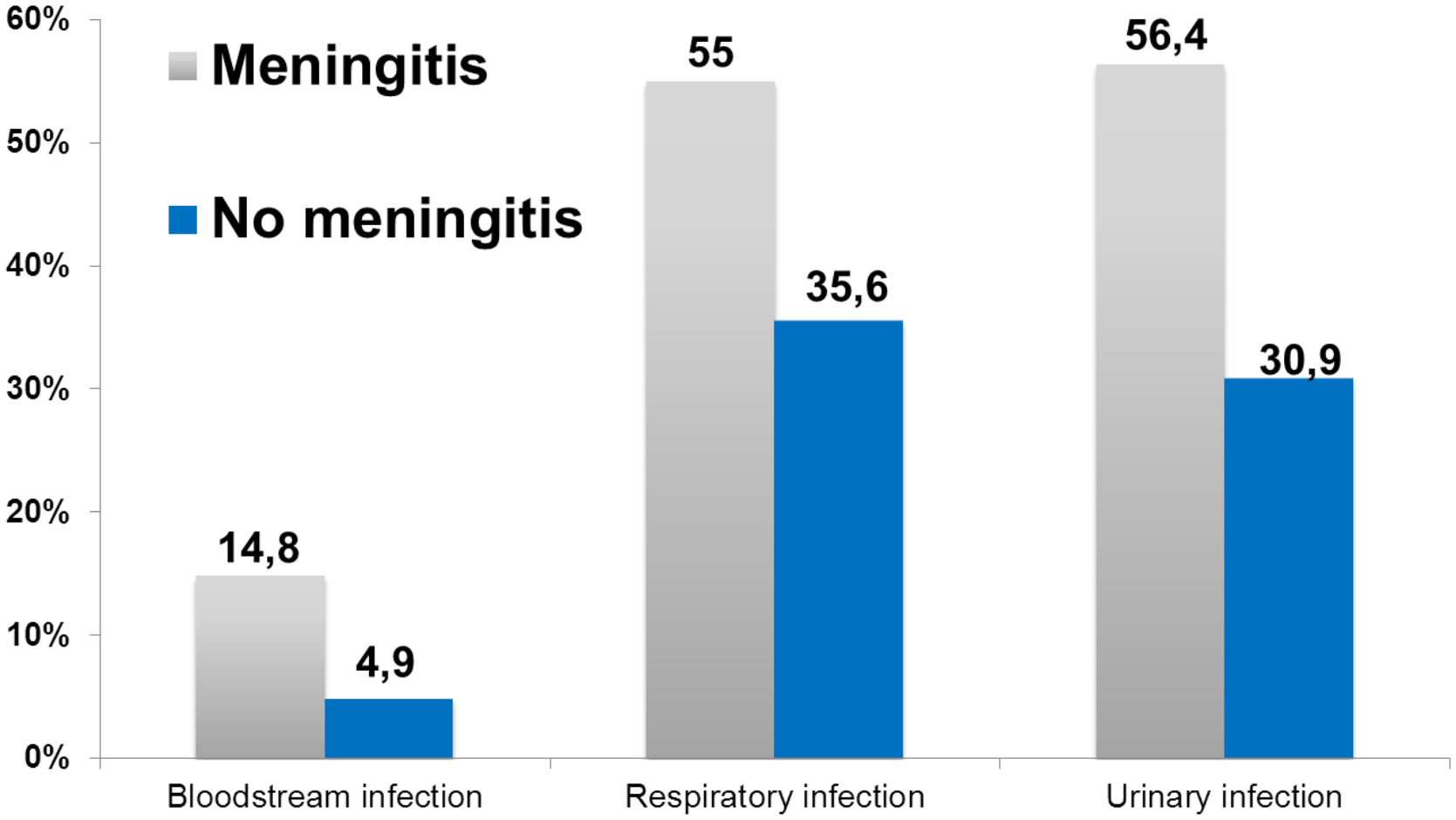
Kourbeti I. S. et al. Risk factors associated with postcraniotomy meningitis //Neurosurgery. – 2007. – Т. 60. – №. 2. – С. 317-326.

Korinek A. M. et al. Risk Factors for Adult Nosocomial Meningitis After Craniotomy Role of Antibiotic Prophylaxis //Neurosurgery. – 2006. – Т. 59. – №. 1. – С. 126-133.

Хирургические факторы риска (наше исследование)

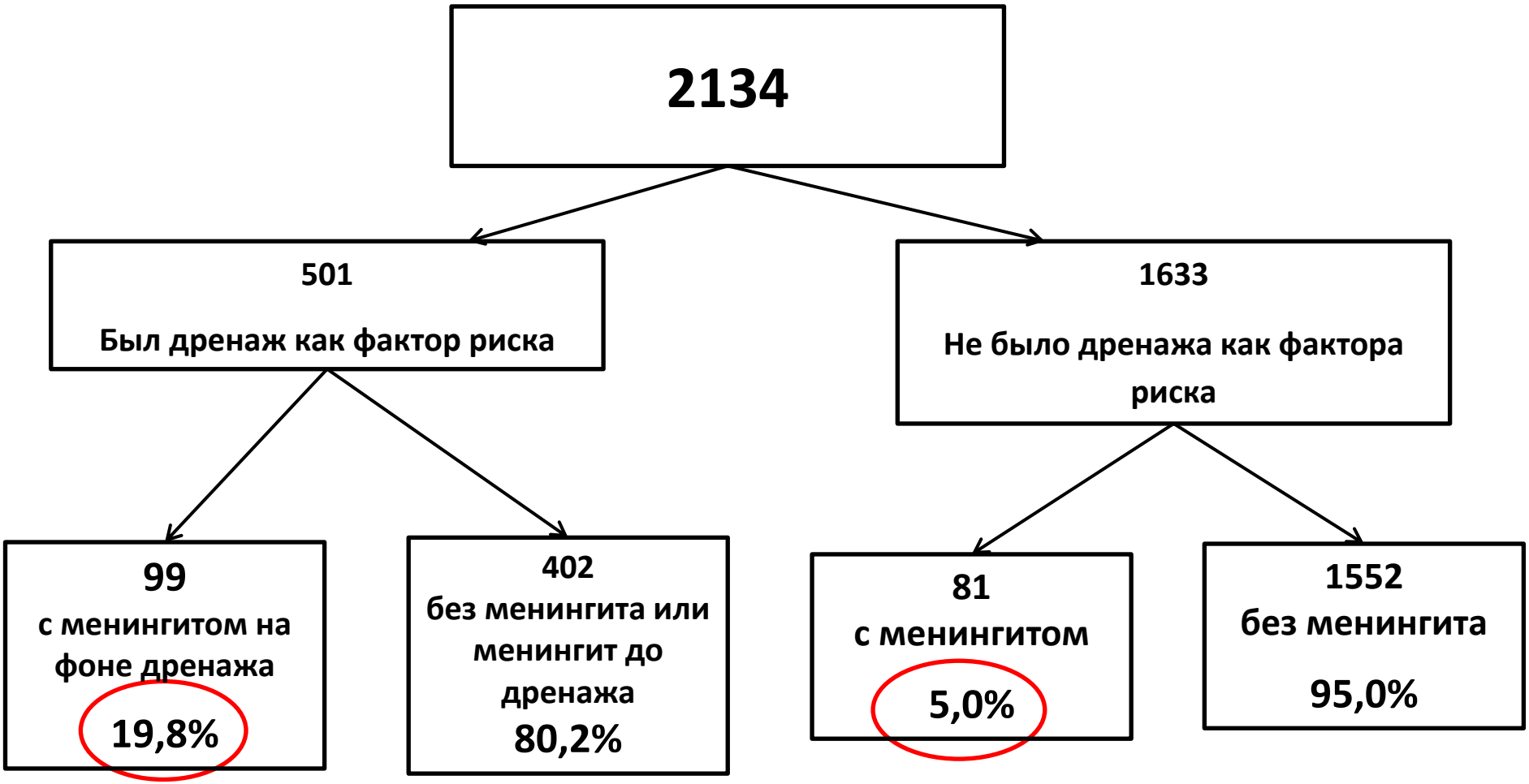


Инфекции другой локализации (%) (наше исследование)



Случаи

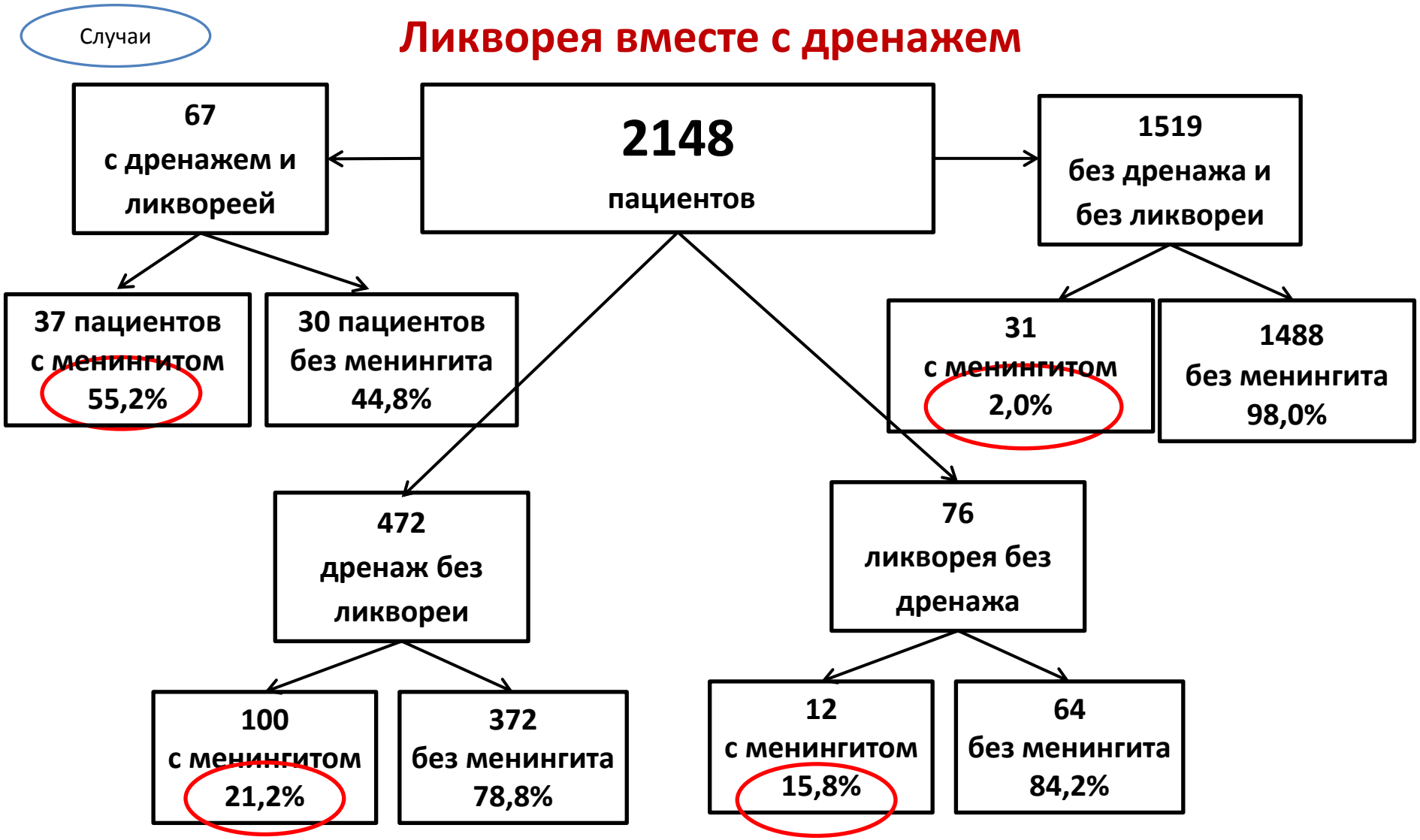
Дренаж как фактор риска



Риск менингита в группе с дренажем – 0,198 (19,8%)

Риск менингита в группе без дренажа – 0,050 (5,0%)

Относительный риск развития менингита у пациентов с дренажем 3,96 p < 0.01

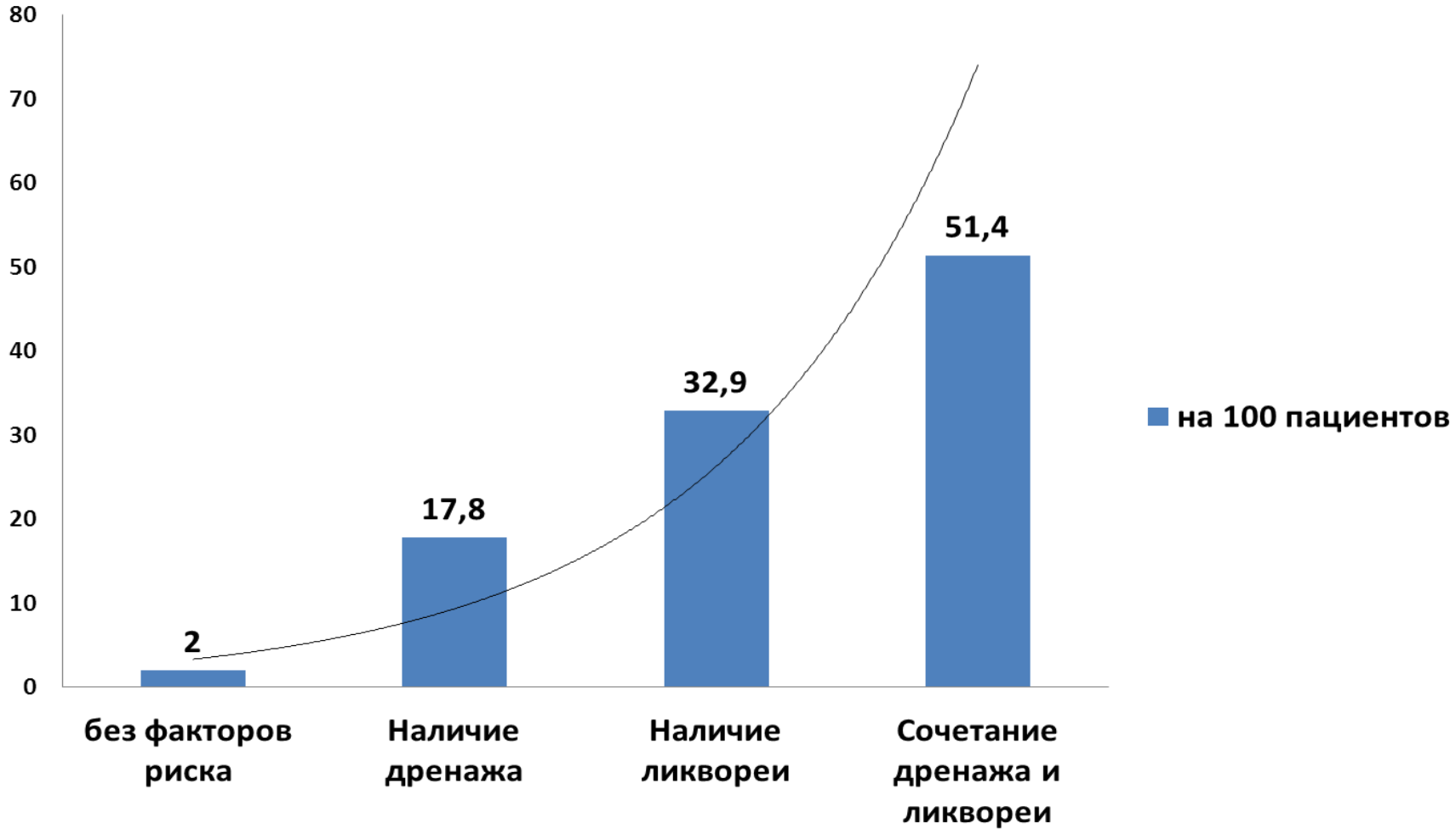


Риск менингита в группе с дренажем и ликвореей – 0,552 (55,2%)

Риск менингита в группе без дренажа и без ликвореи – 0,02 (2,0%)

Относительный риск развития менингита 27,6 р ($p<0.01$)

Риск развития менингита у пациентов в ОРИТ



У пациента в ОРИТ вероятность менингита выше

- С НВД ≈ в 4 раза
- С ликвореей ≈ в 5,2 раза
- С ликвореей+НВД ≈ в 27,6 раз

В сравнении с пациентом без НВД

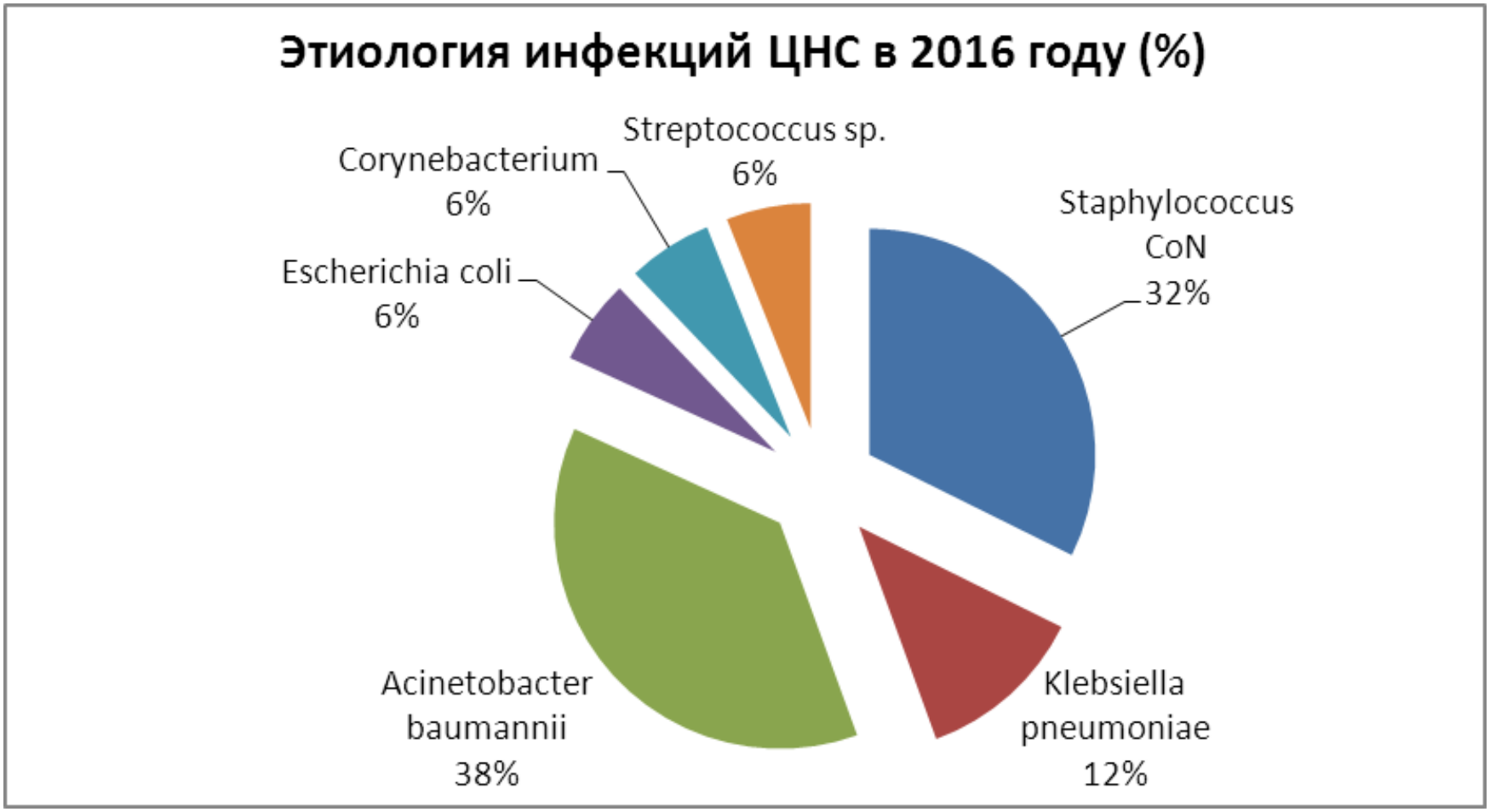
Table 2. Recommended Empirical Antimicrobial Therapy for Nosocomial Bacterial Meningitis, According to the Pathogenesis of the Infection.

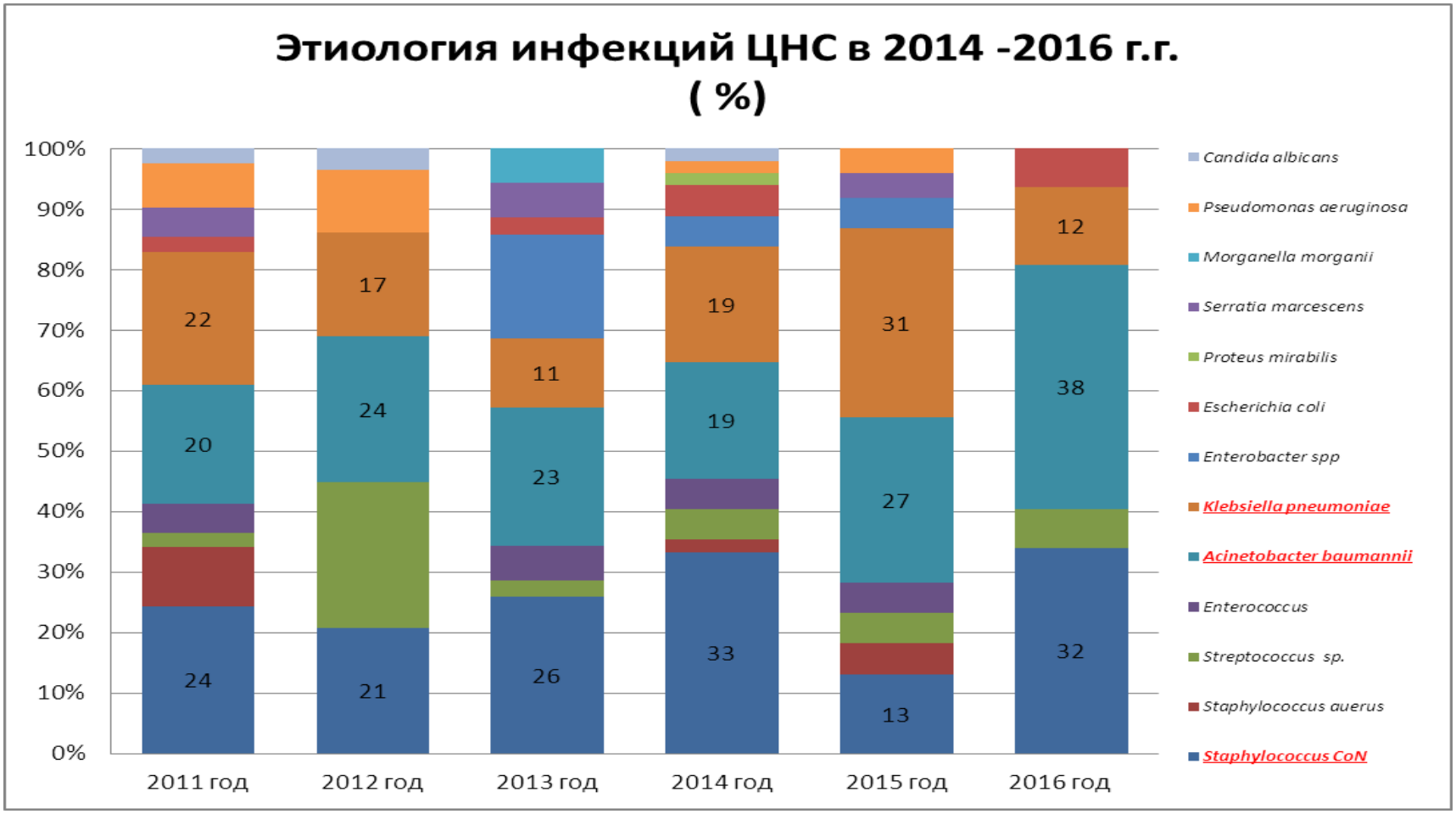
Pathogenesis	Common Bacterial Pathogens	Antimicrobial Therapy*
Postneurosurgical infection	Facultative and aerobic gram-negative bacilli (including *Pseudomonas aeruginosa*), *Staphylococcus aureus*, and coagulase-negative staphylococci (especially *S. epidermidis*)	Vancomycin plus cefepime, ceftazidime, or meropenem†
Ventricular or lumbar catheter	Coagulase-negative staphylococci (especially *S. epidermidis*), *S. aureus*, facultative and aerobic gram-negative bacilli (including *P. aeruginosa*), *Propionibacterium acnes*	Vancomycin plus cefepime, ceftazidime, or meropenem†
Penetrating trauma	*S. aureus*, coagulase-negative staphylococci (especially *S. epidermidis*), facultative and aerobic gram-negative bacilli (including *P. aeruginosa*)	Vancomycin plus cefepime, ceftazidime, or meropenem†
Basilar skull fracture	*Streptococcus pneumoniae*, *Haemophilus influenzae*, group A β-hemolytic streptococci	Vancomycin plus a third-generation cephalosporin (i.e., ceftriaxone or cefotaxime)

* The preferred daily dosages of antimicrobial agents in adults with normal renal and hepatic function are as follows: vancomycin, 15 mg per kilogram of body weight every 8 to 12 hours to maintain a serum vancomycin trough concentration of 15 to 20 μg per milliliter; cefepime, 2 g every 8 hours; ceftazidime, 2 g every 8 hours; meropenem, 2 g every 8 hours; ceftriaxone, 2 g every 12 hours; and cefotaxime, 2 g every 4 to 6 hours. For patients with severe allergy to penicillin or cephalosporins, aztreonam, 2 g every 6 to 8 hours, or ciprofloxacin, 400 mg every 8 to 12 hours, can be used for treatment of infection caused by gram-negative bacilli.

† The choice of the specific agent should be based on local antimicrobial susceptibility of aerobic gram-negative bacilli.

van de Beek D., Drake J. M., Tunkel A. R. Nosocomial bacterial meningitis //New England Journal of Medicine. – 2010. – Т. 362. – №. 2. – С. 146-154.


Этиология инфекций ЦНС в 2016 году (%)
Streptococcus sp.
6%
Corynebacterium
6%
Escherichia coli
6%
Staphylococcus
CoN
32%
Acinetobacter
baumannii
38%
Klebsiella
pneumoniae
12%


Этиология инфекций ЦНС в 2014 -2016 г.г.
(%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2011 год
2012 год
2013 год
2014 год
2015 год
2016 год
22
20
24
17
24
21
11
23
26
19
19
33
31
27
13
12
38
32
Candida albicans
Pseudomonas aeruginosa
Morganella morganii
Serratia marcescens
Proteus mirabilis
Escherichia coli
Enterobacter spp
Klebsiella pneumoniae
Acinetobacter baumannii
Enterococcus
Streptococcus sp.
Staphylococcus auerus
Staphylococcus CoN

Патогены ЦНС

N= число случаев	2014 год	2015 год	2016 год
Staphylococcus CoN	13	3	5
Staphylococcus auerus	1	1	0
Streptococcus sp.	2	1	1
Enterococcus	2	1	0
Acinetobacter baumannii	7	6	6
Klebsiella pneumoniae	7	7	2
Enterobacter spp	2	1	0
Escherichia coli	2	0	1
Proteus mirabilis	1	0	0
Serratia marcescens	0	1	0
Pseudomonas aeruginosa	1	1	0
Candida albicans	1	0	0

Антимикробная терапия нозокомиальных менингитов

Эмпирическая

Меронем 6 г/сут, или Дорипенем 3 г/сут в виде продленной инфузии +

Ванкомицин 3/сут, в/в

Valproic Acid Plasma Concentration Decreases in a Dose-Independent Manner Following Administration of Meropenem: A Retrospective Study

Simon Haroutiunian, MSc, Yael Ratz, BSc, Bella Rabinovich, MSc, Miriam Adam, MSc, and Amnon Hoffman, PhD

Several case reports indicate that carbapenem antibiotics, especially meropenem, may decrease the plasma concentrations of valproic acid (VPA), thus decreasing its therapeutic activity. To investigate the onset, severity, and dose dependency of the interaction between meropenem and VPA, the authors carried out a retrospective evaluation of data collected during 24 months from patients hospitalized in a tertiary medical center. The analysis included 36 patients. VPA mean ± SEM plasma concentration decreased from of 50.8 ± 4.5 μg/mL to 9.9 ± 2.1 μg/mL ($P < .001$) following meropenem administration. After discontinuation of meropenem, VPA plasma concentrations remained low for 7 days and then gradually increased after 8 to 14 days, reaching values comparable to those before meropenem initiation. Different daily VPA doses showed a similar pattern of decreased VPA concentrations. The mean decrease in individual plasma VPA concentration was 82.1% ± 2.7%. The mean VPA plasma concentration of patients in whom samples were drawn within 24 hours of meropenem initiation was 9.9 ± 3.2 μg/mL. In conclusion, the interaction between meropenem and VPA causes a significant decrease in VPA plasma concentration, apparently within 24 hours. As the therapeutic effects of VPA are plasma concentration dependent, the data suggest that these drugs should not be administered concomitantly.

Keywords: *Meropenem; valproic acid; drug-drug interaction; epilepsy; pharmacokinetics*

Journal of Clinical Pharmacology, 2009;49:1363-1369

Меронем значительно снижает концентрацию вальпроевой кислоты (эффект дозозависимый)

Меронем не должен назначаться с вальпроатами одновременно

Action on electroencephalogram (EEG) and behavior

When the drug was directly administered in the lateral ventricle to adult dogs, Doripenem did not affect electroencephalogram (EEG) and behavior at 1000 μg/dog.

Test drug	Dose (μg/dog)	EEG	Behavior
Doripenem	**100**	**Not affected**	**Not affected**
	300	**Not affected**	**Not affected**
	1000	**Not affected**	**Not affected**
Meropenem	100	Spike wave (1), local seizure discharge (hippocampus) (1)	Not affected
	300	Spike wave (1), multiple spike complex (1), generalized seizure dischargegeneral (1)	**Clonic convulsion (1),** spasm (1)
	1000	EEG activation (1), spike potential (1), spike-and-slow-wave complex (1), local seizure discharge (hippocampus) (1), generalized seizure dischargegeneral (2)	Clonic convulsion (2), spasm (1), hyperactivity (1), facial spasm (1)
Imipenem	30	Not affected	Not affected
	100	spike-and-slow-wave complex (1), generalized seizure dischargegeneral (1)	**Clonic convulsion (1)**, facial spasm (1), spasm (1), fall (1)
	300	Spike wave (3), multiple spike complex (2), multiple spike-and-slow-wave complex (1), local seizure discharge (hippocampus) (2),generalized seizure dischargegeneral (1)	**Clonic convulsion (1)**, facial spasm (3), spasm (1), vomiting (2)

Horiuchi, M., *Toxicology*, 222, 114, 2006

CSF penetration and clinical use

Compound (reference[s] for CSF penetration)	AUC_{CSF}/AUC_S		Description
	Uninflamed	Inflammation	
β-Lactamase inhibitors	**0.07**	**0.1**	Sulbactam Little experience with *in vivo* activity in meningitis in humans; high-dose sulbactam (up to 8 g/day) was used successfully to treat *Acinetobacter* meningitis
Cephalosporins	**0.007-0.1**	**0.15**	Low toxicity; daily dose can be increased up to 12-24 g (cefotaxime)
Carbapenems	**0.2**	**0.3**	**Meropenem meningitis dose of 6 g/day; Doripenem -3 g/d. Proconvulsive activity of imipenem**
Aminoglycosides	**0.2**	**Not available**	High toxicity precludes strong increase of the daily dose; **consider intrathecal application**
Fluoroquinolones	**0.3-0.7**	**0.7-0.9**	Effective compounds with favorable CNS pharmacokinetics; suitable therapy for susceptible bacteria (Gram-negative aerobic bacilli
Tetracyclines Doxycycline	**0.2**	**0.2**	Documented effectiveness for neuroborreliosis, -brucellosis, and -syphilis
Linezolid	**0.9 (0.8-1)**	**Not available**	Reserve antibiotic for S. aureus and Enterococcus sp. CNS infections
Vancomycin	**0.18, 0.14**	**0.30 (0.29-0.48)**	Standard therapy for CNS infections by methicillin-resistant S. aureus and multiresistant S. high CSF-to-serum ratios were determined during **continuous infusion of a high vancomycin dose (60 mg/kg/day)**

Nau R., Sörgel F., Eiffert H. Penetration of drugs through the blood-cerebrospinal fluid/blood-brain barrier for treatment of central nervous system infections //Clinical microbiology reviews. – 2010. – Т. 23. – №. 4. – С. 858-883

Антимикробная терапия

Этиотропная

при верификации возбудителя менингита,
особенно MDR,
интратекальное введение антибиотиков
+
Системное
≈ 21 сут = 3 (-) бакпосева
Элиминация возбудителя ПЦР

Table 3. Recommended Doses of Selected Antimicrobial Agents Administered by the Intraventricular Route.*

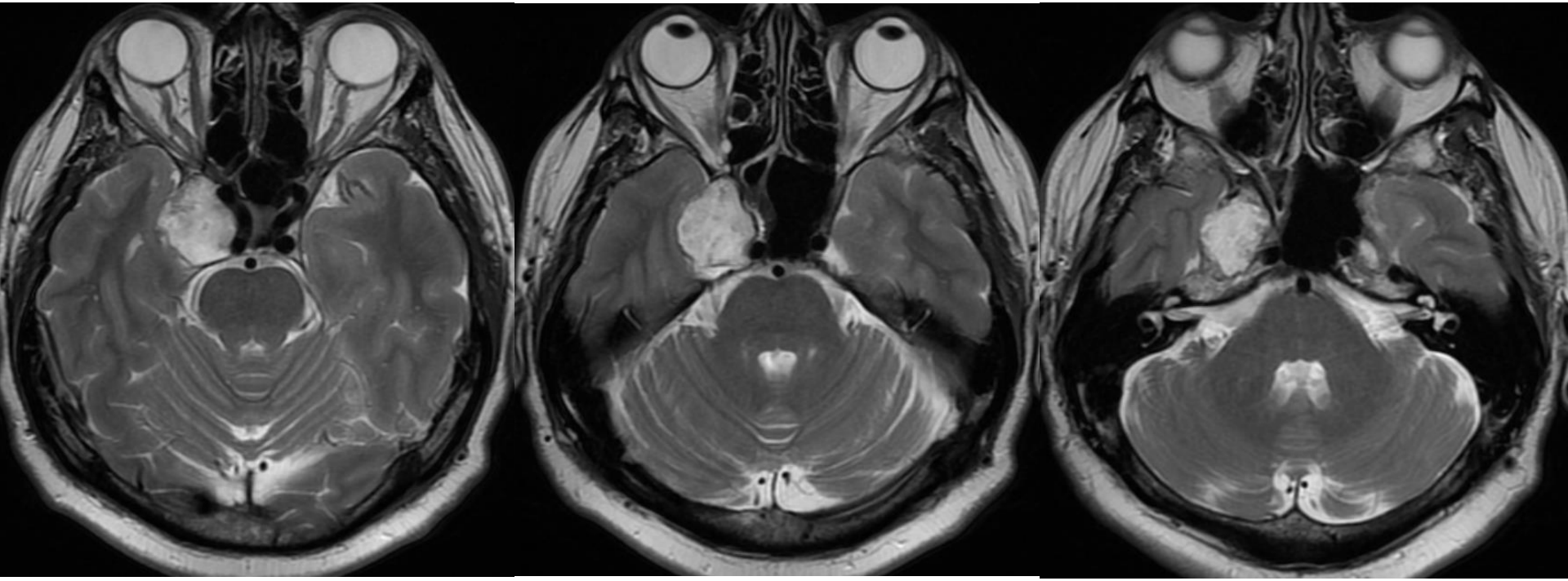
Antimicrobial Agent	Daily Intraventricular Dose
Vancomycin	5–20 mg†
Gentamicin	1–2 mg in infants and children; 4–8 mg in adults
Amikacin	5–50 mg‡
Polymyxin B	2 mg in infants and children; 5 mg in adults
Colistin, usually formulated as colistimethate sodium	10 mg once daily or 5 mg every 12 hr§

* There are no data that define the exact dose of an antimicrobial agent that may be administered by the intraventricular route, but the dose can be estimated through the measurement of the cerebrospinal fluid trough concentration, in the case of agents for which these measurements can be obtained. Medications administered by the intraventricular route should be preservative-free.
† Most studies have used a 10-mg or 20-mg dose.
‡ The usual daily dose is 30 mg.
§ In one study, patients received 10 mg every 12 hours without an increase in side effects.[35]

Practice Guidelines for the Management of Bacterial Meningitis, Clinical Infectious Diseases Volume 39, Issue 9

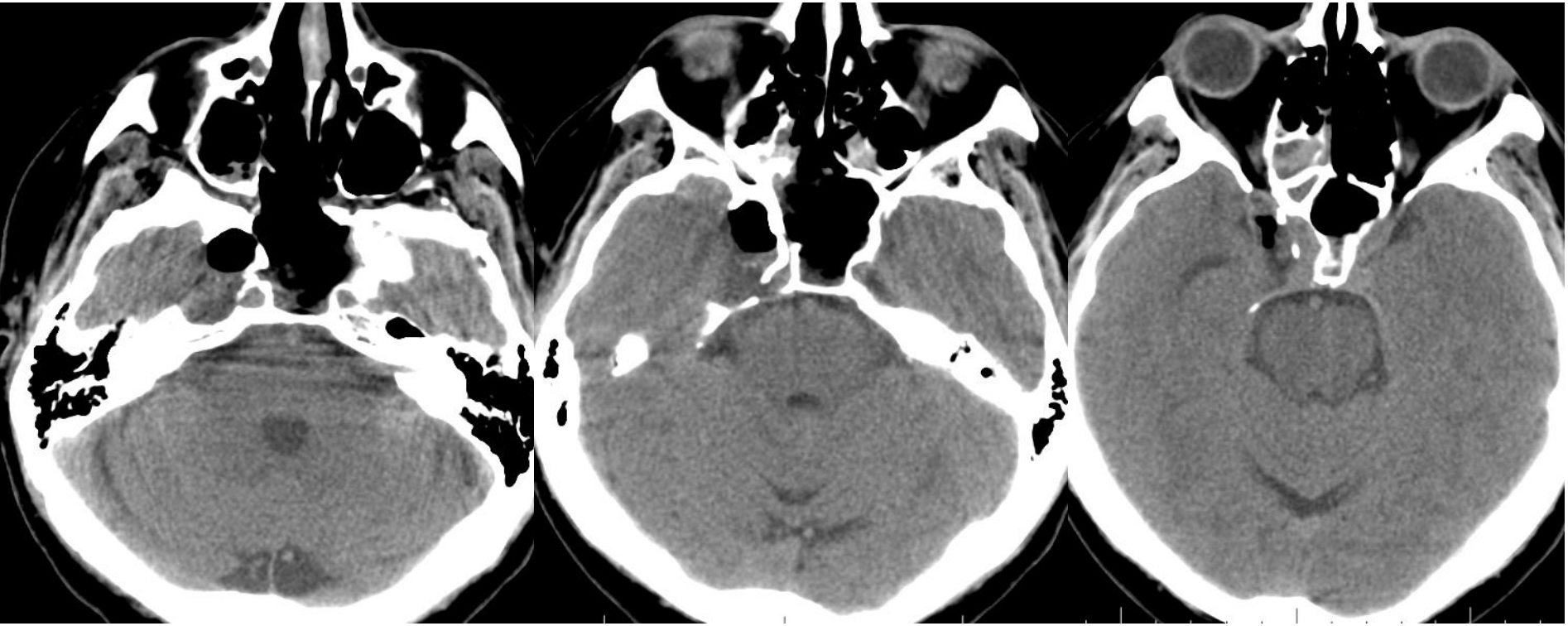
van de Beek D., Drake J. M., Tunkel A. R. Nosocomial bacterial meningitis //New England Journal of Medicine. – 2010. – Т. 362. – №. 2. – С. 146-154.

Пациент М-ий А.В. 50 лет VIII отделение
холестеотома правого кавернозного синуса



02.12.2013:
Эндоскопическое транссфеноидальное удаление опухоли

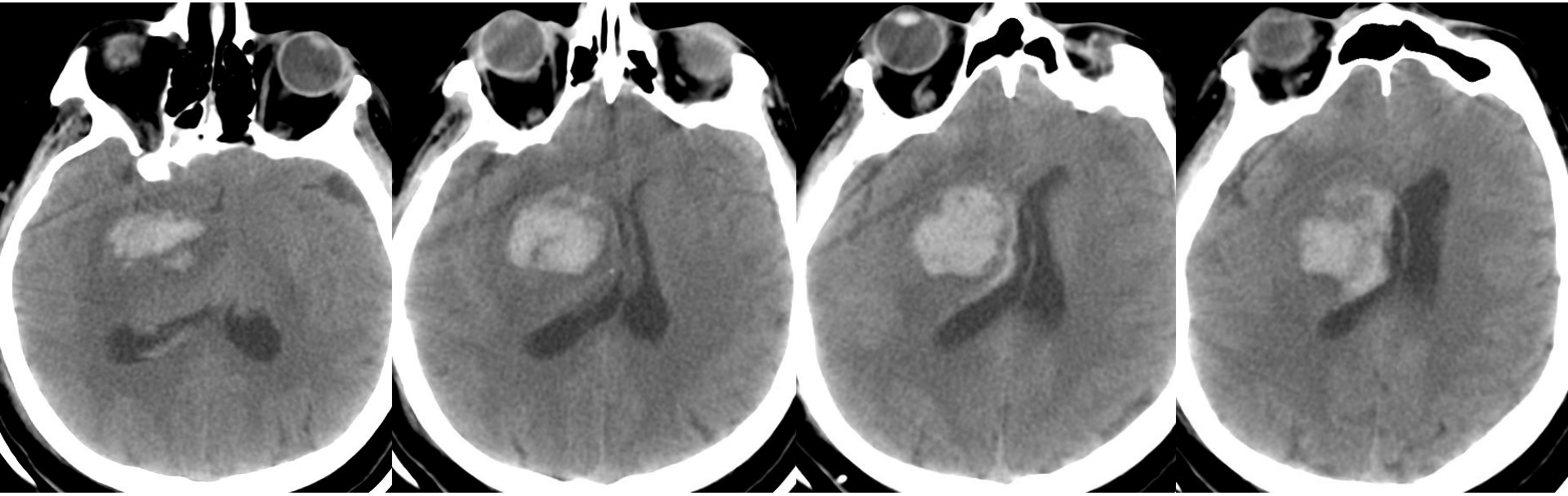
Течение послеоперационного периода



9-е п/о сутки:

Назальная ликворея, менингит (анаэробные Гр- бактерии). Ревизия основной пазухи. Антибактериальная терапия. Нормализация ликвора

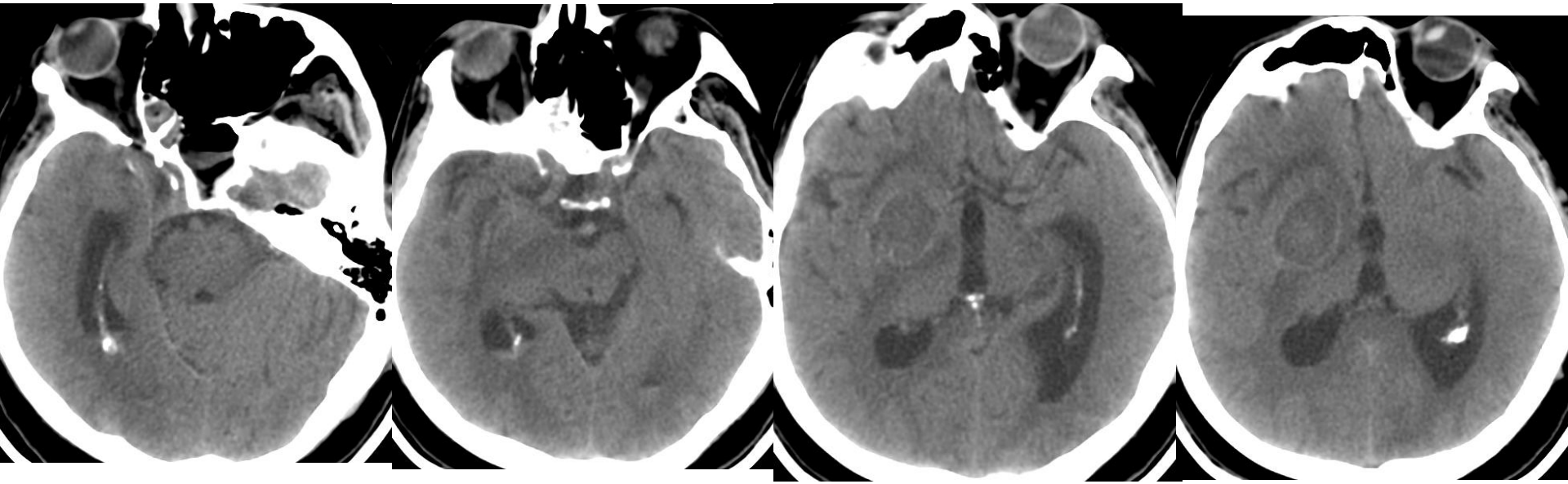
Течение послеоперационного периода



35-е п/о сутки:

Геморрагический инсульт, 2-ой рецидив менингита (*Klebsiella pneumonia*). Коррекция а/б-терапии. Трахеостомия. Нормализация ликвора. Стабилизация состояния. Перевод в VIII отделение (21 сут)

Течение послеоперационного периода



42-е п/о сутки:

Кома, левосторонняя гемиплегия, 3-й рецидив менингита (*Ацинетобактер*).

Не подтвердившееся подозрение на абсцесс.

Management of meningitis due to antibiotic-resistant *Acinetobacter* species

Baek-Nam Kim, Anton Y Peleg, Thomas P Lodise, Jeffrey Lipman, Jian Li, Roger Nation, David L Paterson

Acinetobacter meningitis is becoming an increasingly common clinical entity, especially in the postneurosurgical setting, with mortality from this infection exceeding 15%. Infectious Diseases Society of America guidelines for therapy of postneurosurgical meningitis recommend either ceftazidime or cefepime as empirical coverage against Gram-negative pathogens. However, assessment of the pharmacodynamics of these cephalosporins in cerebrospinal fluid suggests that recommended doses will achieve pharmacodynamic targets against fewer than 10% of contemporary acinetobacter isolates. Thus, these antibiotics are poor options for suspected acinetobacter meningitis. From in vitro and pharmacodynamic perspectives, intravenous meropenem plus intraventricular administration of an aminoglycoside may represent a superior, albeit imperfect, regimen for suspected acinetobacter meningitis. For cases of meningitis due to carbapenem-resistant acinetobacter, use of tigecycline is not recommended on pharmacodynamic grounds. The greatest clinical experience rests with use of polymyxins, although an intravenous polymyxin alone is inadvisable. Combination with an intraventricularly administered antibiotic plus removal of infected neurosurgical hardware appears the therapeutic strategy most likely to succeed in this situation. Unfortunately, limited development of new antibiotics plus the growing threat of multidrug-resistant acinetobacter is likely to increase the problems posed by acinetobacter meningitis in the future.

Lancet Infect Dis 2009; 9: 245–55

University of Queensland Centre for Clinical Research (B-N Kim MD, J Lipman MD, D L Paterson FRACP), and Department of Critical Care Medicine (J Lipman), Royal Brisbane and Women's Hospital, Brisbane, Australia; Department of Internal Medicine, Ajou University College of Medicine, Seoul, South Korea (B-N Kim); Division of Infectious Diseases, Beth Israel Deaconess Medical Center and Harvard Medical School, USA (A Y Peleg FRACP); Albany College of Pharmacy, Pharmacy Practice Department, Albany, New York, USA (T P Lodise PharmD); Facility for Anti-infective Drug Development and Innovation, Drug Delivery, Disposition and Dynamics, Monash Institute of Pharmaceutical Sciences, Monash University, Victoria, Australia (J Li PhD, R Nation PhD); Centre for Healthcare Related Infection Surveillance and Prevention, Queensland Health, Brisbane (D L Paterson)

Correspondence to: David L Paterson, Infectious Diseases Unit, 6th Floor, West Block, Royal Brisbane and Women's Hospital, Brisbane, Queensland, Australia. david.antibiotics@gmail.com

Introduction

Acinetobacter baumannii is a nosocomial pathogen of increasing importance.[1] Outbreaks of infection with the organism have been noted in every inhabited continent in the past decade, with nosocomial pneumonia being the most common clinical manifestation.[2] Of substantial concern has been the increasing prevalence of multidrug resistance in hospital isolates of *A baumannii* during the past decade. The organism can possess an impressive armamentarium of resistance mechanisms—the end result being resistance to all, or almost all, commercially available antibiotics.[2]

The purpose of this Review is to concentrate on the entity of acinetobacter meningitis. Speciation of organisms in the genus *Acinetobacter* is sometimes difficult,[3,4] so this Review describes infection with all *Acinetobacter* spp. The epidemiology of this infection is reviewed, and management of this infection is discussed in detail. In particular, the management of infection is

meningitis reported that acinetobacter accounted for 11·2% (20/178) of cases.[13] In large series in the USA and Taiwan, acinetobacter ranked the fifth most common genus to be associated with nosocomial meningitis.[5,8] However, two recent studies from Turkey have documented acinetobacter as the leading cause of Gram-negative postneurosurgical meningitis.[14,15]

Risk factors

Acinetobacter meningitis typically occurs following neurosurgery (table 1). Patients at risk for post-neurosurgical bacterial meningitis include those with cerebrospinal leakage,[63] concomitant incision infection,[63] prolonged duration of surgery,[63] surgery that enters a sinus,[64] increased severity of illness,[64,65] prolonged external ventricular drainage,[64,65] and need for repeat surgery.[66] The median time to develop acinetobacter meningitis after a neurosurgical procedure is 12 days (range 1–40 days).[58] Prior use of extended-spectrum

ACINETOBACTER carbopenem-resistant

Внутривенно:
Карбопенемы + Тигацил

Интратекально:
Полимиксин + Амикацин

В какой дозе интратекально?

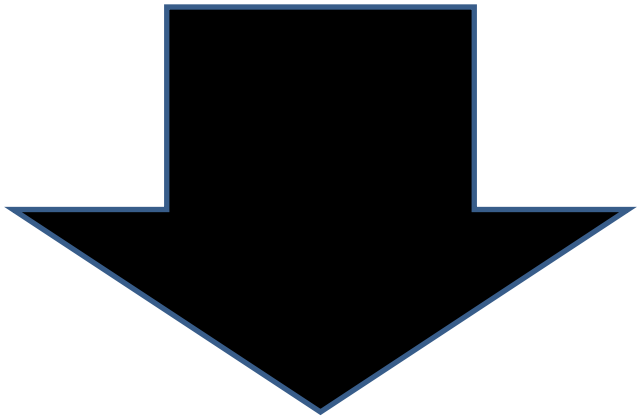
Полимиксин:

- Для Колистина (полимикс Е) в инструкции интратекальное использование не указано
- По данным литературы, 5-10 мг

- Для Вилимиксина (полимикс В) в инструкции: только для синегнойного менингита в дозе 5 мг х 1 р/сут 6 – 8 суток

Пациент М.

- Амикацин 50 мг х 1 раз в сутки
- Колистин 40 мг х 1 раз в сутки
- В течение 25 суток (от момента стерильного ликвора + 5 суток)



Пациент переведен в VIII отделение 14.03.2014, сознание ясное, глубокий левосторонний гемипарез

neurocritical care society Neurocrit Care (2016) 25:167–169
DOI 10.1007/s12028-016-0314-2

EDITORIAL

Prevention of Nosocomial Infection in the Neurosciences Intensive Care Unit: Remember the Basics

Rob Boots[1,2]

such as head injury or intracranial bleed. An [illegible] approach to such checklist review includes **FASTHUG**: **F**eeding and nutrition including route and specific requirements while minimizing the use of parenteral nutrition; **A**nalgesia to ensure pain relive and avoidance of analgesic complications such as constipation and respiratory depression; **S**edation/sleep management to improve comfort and reduce delirium; **T**hromboembolism prophylaxis; **H**ead-up measures to prevent aspiration; **U**lcer prophylaxis including stress, decubitus and device related; and **G**lycemic control. Additionally, **ON-FIDDLER** prompts for **O**rgan support with review of requirements and settings for cardiovascular and respiratory support; **N**otification of who needs to know about what, using the most efficient communication method with chart entries having legible dates, times, and signatures; **F**luid management including fluid type appropriateness, need for supplementary fluids, and the assessment of fluid deficit or excess; **I**nfection management including isolation requirements, draining collections, surveillance cultures as required with correct antibiotic use, appropriate infection prophylaxis, and antibiotic therapy duration; **D**ialysis and all things related to the kidney; **L**ines including all invasive

(OPTIMISM) Study. Neurocrit Care. 2013;18:318–31.
3. Zygun DA, Zuege DJ, Boiteau PJ, et al. Ventilator-associated pneumonia in severe traumatic brain injury. Neurocrit Care. 2006;5:108–14.
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9. Yi SH, Baggs J, Gould CV, Scott RD 2nd, Jernigan JA. Medicare reimbursement attributable to catheter-associated urinary tract infection in the inpatient setting: a retrospective cohort analysis. Med Care. 2014;52:469–78.
10. Divani AA, Hevesi M, Pulivarthi S, et al. Predictors of nosocomial pneumonia in intracerebral hemorrhage patients: a multi-center observational study. Neurocrit Care. 2015;22:

neurocritical care society Neurocrit Care (2016) 25:167–169
DOI 10.1007/s12028-016-0314-2

EDITORIAL

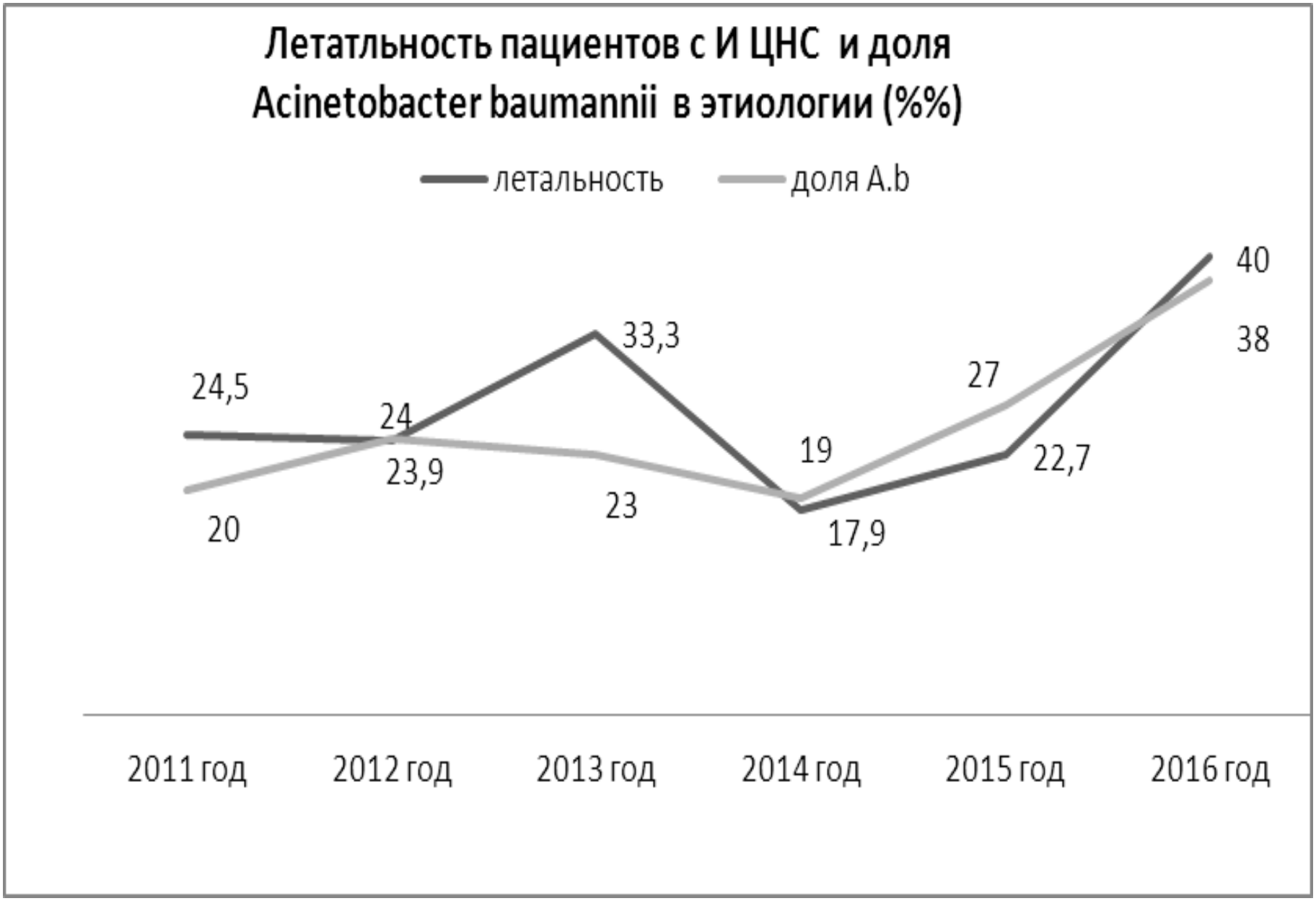
Prevention of Nosocomial Infection in the Neurosciences Intensive Care Unit: Remember the Basics

Rob Boots[1,2]

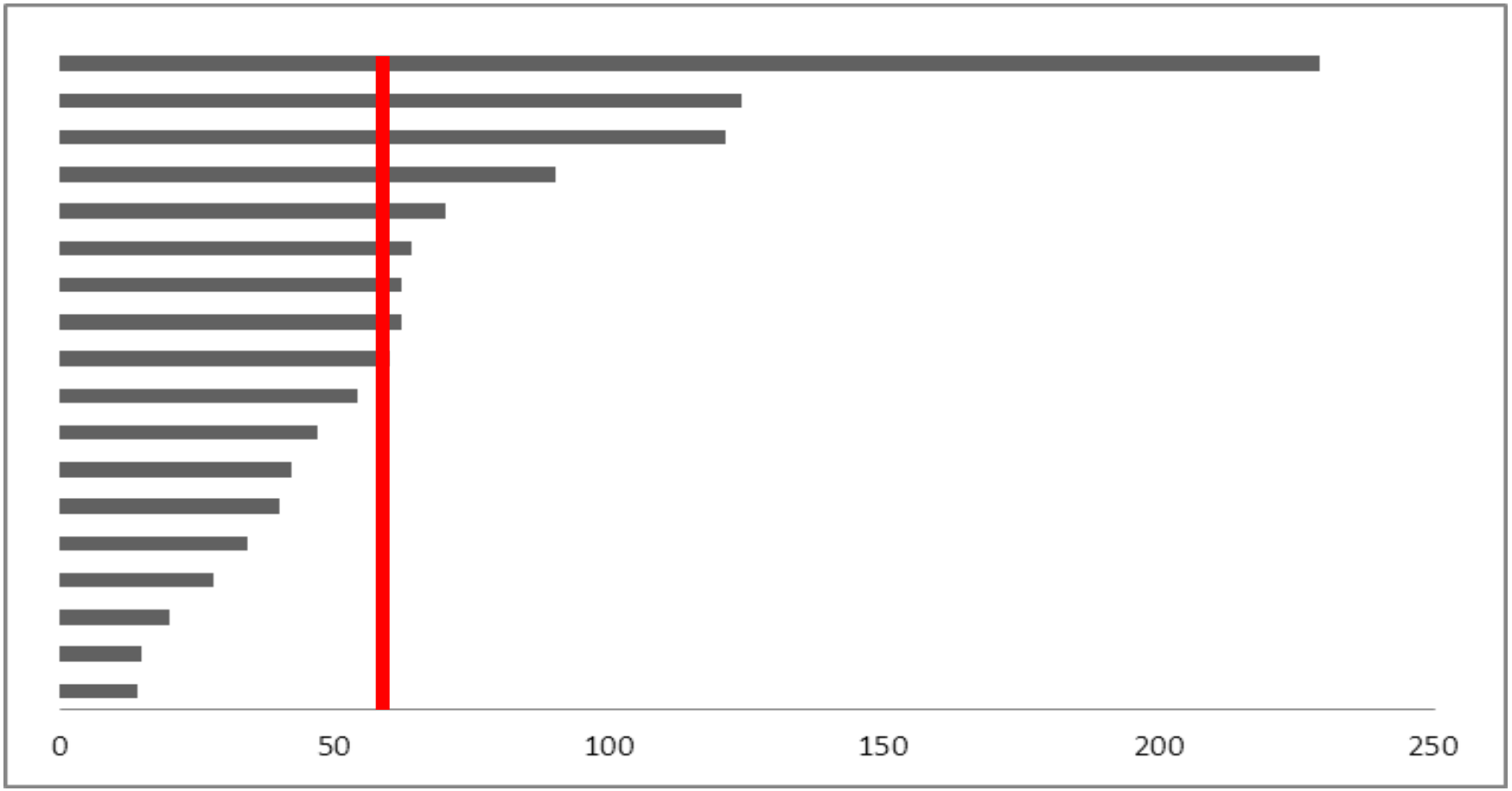
FASTHUG (Feeding, Analgesia, Sedation/Sleep, Thromboembolism prophylaxis, Head up, Ulcer prophylaxis Glycemic control…)

ON-FIDDLER (Organ support.., Notification.., Fluid.., Infections..Dialysis..,Drugs., Lines..,Electrolytes.., Research..)


Летальность
45
40
35
30
25
20
15
10
5
0
24,5
23,9
33,3
17,9
22,7
40
2011 год
2012 год
2013 год
2014 год
2015 год
2016 год


Летатльность пациентов с И ЦНС и доля Acinetobacter baumannii в этиологии (%%)
летальность
доля A.b
24,5
24
33,3
19
22,7
40
20
23,9
23
17,9
27
38
2011 год
2012 год
2013 год
2014 год
2015 год
2016 год

Длительность лечения менингита 16 г



Средняя длительность = 65 дней

Максимальная = 229 дней

Потери от менингита

- Дополнительные дни на лечение менингита
- 65-10,5 = 54,5 для каждого пациента,
- 54,5 х 21 пациента - потери более 1144,5 к/д
- 1 к/день не менее 8 000 руб
- ПОТЕРИ (21 пациент) min - 9 млн 156 тыс руб


Заболеваемость И ЦНС (на 100 пац)
15,8
12,3
10,3
10,5
6,4
6,7
2011 год
2012 год
2013 год
2014 год
2015 год
2016 год

Профилактика нозокомиальных менингитов

Table 1. Neurosurgical Techniques to Minimize the Risk of Postoperative Meningitis.

Before surgery
Wash scalp hair, remove dirt or debris, and cover open wounds with a clean dressing
Clip, but do not shave, hair
Use chlorhexidine or an iodine-based skin preparation
Drape the surgical site with adhesive drapes and transparent adhesive film to prevent implantable hardware from coming in contact with exposed skin
Maintain sterile field with careful aseptic techniques
Administer prophylactic antibiotics to achieve adequate tissue concentrations before incision
During surgery
Minimize blood loss and tissue trauma; avoid hypothermia unless it is deliberately induced
Remove devitalized and grossly contaminated tissue and small bone fragments
Use a double layer of gloves when handling implantable devices
Irrigate the operative field with warmed sterile physiologic solution
Perform careful hemostasis to avoid postoperative wound hematomas
Position the cerebrospinal fluid drainage devices carefully to maintain a continuous flow of cerebrospinal fluid; ensure that the exit site is fashioned so that there is no leakage around the cerebrospinal fluid drain; ensure that the catheter is tunneled from the insertion site and secured to the skin so that it cannot be dislodged and that it is connected securely to a sterile drainage system; sample the cerebrospinal fluid under sterile conditions
Close the skin carefully, with wound edges secured to prevent leakage of cerebrospinal fluid but with good skin perfusion; avoid passing hardware directly beneath the incision
After surgery
Use percutaneous drains to collect postoperative hemorrhage; ensure that the drains are tunneled so that they will not leak and secured so that they cannot be dislodged
Apply a barrier dressing where necessary, particularly to prevent the patient from inadvertently opening the wound
Avoid putting pressure on the wound in the postoperative period; take measures to prevent pressure sores in other areas

Профилактика

<u>До операции</u>

Вымыть голову

Не брить

Использовать хлоргексидин на кожу

Протокол антибиотикопрофилактики

<u>Во время операции</u>

Минимизация кровопотери

Избегать охлаждения

Использовать двойные перчатки

Промывать операционную рану теплым стерильным физиологическим раствором

После операции...

Профилактика менингита в реанимации (I)

- Поверхостные инфекции в обл операции
- Ликворея
- «Беречь» п/оп рану (профилактика Давления)
- НВД – один нейрохирург
- НВД - Закрыт стерильной пеленкой
- Смена мешка только при необходимости
- Забор ликвора только нейрохирург (один нейрохирург) по строгим показаниям
- ИНФЕКЦ КОНТРОЛЬ и Г ИГИЕНА РУК (СПИРТ)

Инфекции в области нейрохирургического вмешательства *

Поверхностные

- разреза кожи
- слизистых оболочек или костной ткани черепа
- нагноение раны

Глубокие

- менингит,
- вентрикулит
- менингоэнцефалит

CDC/NHSN Surveillance HAI criteria, 2011

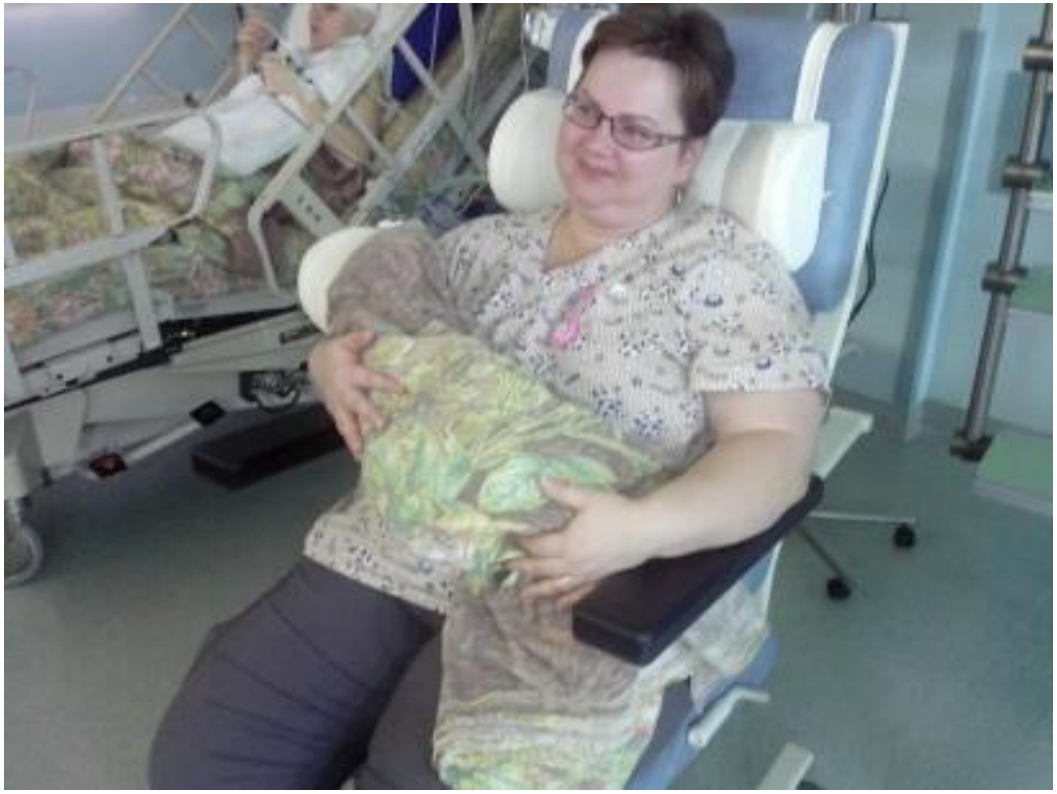
Профилактика в реанимации (II)

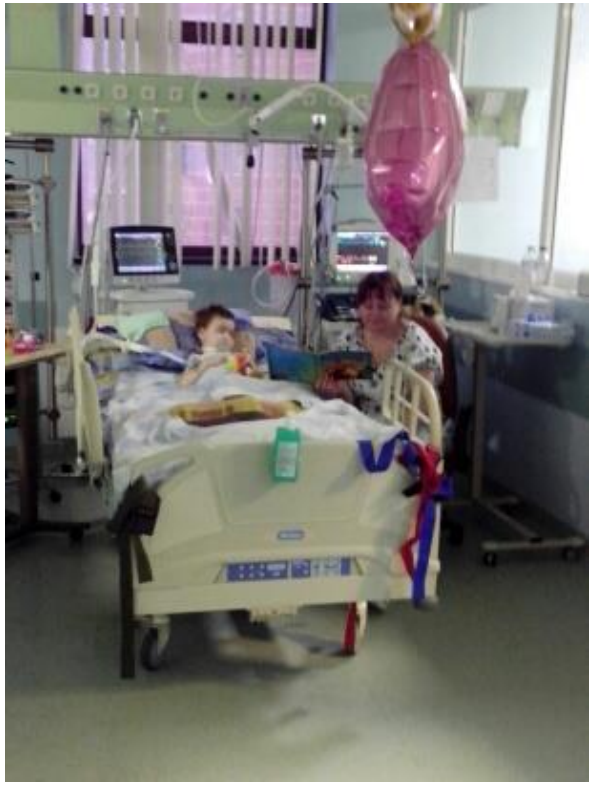
- Инфекционный Контроль – Реально Действующий!
- Использование закрытых аспирационных систем и для отведения стула (при диареи у пациента)
- Эффективные Дезинфектанты!
- Уход за кожными покровами
- Санация полости рта
- Профилактика кросс-инфицирования – ГИГИЕНА РУК

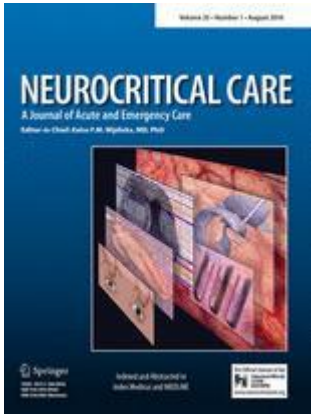
Профилактика контаминации окружающей среды

Использование закрытых аспирационных систем

Родственники -
не причина НОЗОКОМИАЛЬНЫХ ИНФ







Volume 24, Issue 1, February 2016
ISSN: 1541-6933

The Insertion and Management of External Ventricular Drains: An Evidence-Based Consensus Statement : A Statement for Healthcare Professionals from the Neurocritical Care Society.

Herbert I. Fried, Barnett R. Nathan, A. Shaun Rowe, Joseph M. Zabramski, Norberto Andaluz, Adarsh Bhimraj, Mary McKenna Guanci, David B. Seder, Jeffrey M. Singh

Fried H. I. et al. The Insertion and Management of External Ventricular Drains: An Evidence-Based Consensus Statement //Neurocritical care. – 2016. – Т. 24. – №. 1. – С. 61-81.

Утверждаю _____
Заместитель директора по лечебной работе
Главный врач ФГАУ «НИИ нейрохирургии им. Н.Н. Бурденко» Минздрава России
Л.Ю. Глазман
«_8_» сентября 2016 года

Порядок

работы с пациентами с наличием наружного вертрикулярного (люмбального) дренажа

1. Наружный вентрикулярный (люмбальный) дренаж (НВД/НЛД) устанавливают в операционной, в перевязочной или палате отделения, а также в отделении реанимации и интенсивной терапии в зависимости от клинической ситуации.
2. Антибиотикопрофилактику инфекции при установке НВД проводят по схеме: 1 доза амоксициллина/клавуланата - 1,2 г. за 30 минут до манипуляции, кроме пациентов, кто уже получает антибиотики. В экстренных случаях введение антимикробного препарата проводят в момент манипуляции. Длительное назначение антибиотиков пациентам с НВД не показано.
3. Постановку НВД/НЛД выполняет нейрохирург, которому помогает ассистент - медицинская сестра или другой нейрохирург.
4. Перед постановкой НВД/НЛД проводят хирургическую обработку рук, так же как это выполняется в операционной перед операцией.

Антибиотики при НВД

- Антибиотикопрофилактика при установке НВД : 1,2 г. амоксициллина/клавуланата - за 30 мин. до манипуляции - ОДНОКРАТНО, кроме пациентов, кто уже получает антибиотики.

- Длительное назначение антибиотиков пациентам с НВД не показано

НВД

ДЛИТЕЛЬНОСТЬ НВД БЕЗ ВЕНТРИКУЛИТА 5 суток

(это относительно безопасно в условиях осуществляемого ИК в ОРИТ НИИ Бурденко)

НАРУЖНОЕ ДРЕНИРОВАНИЕ ЛИКВОРНЫХ ПРОСТРАНСТВ

ЛЮБЕЗНО ПРЕДОСТАВЛЕНА
Ю.В.КУШЕЛЕМ

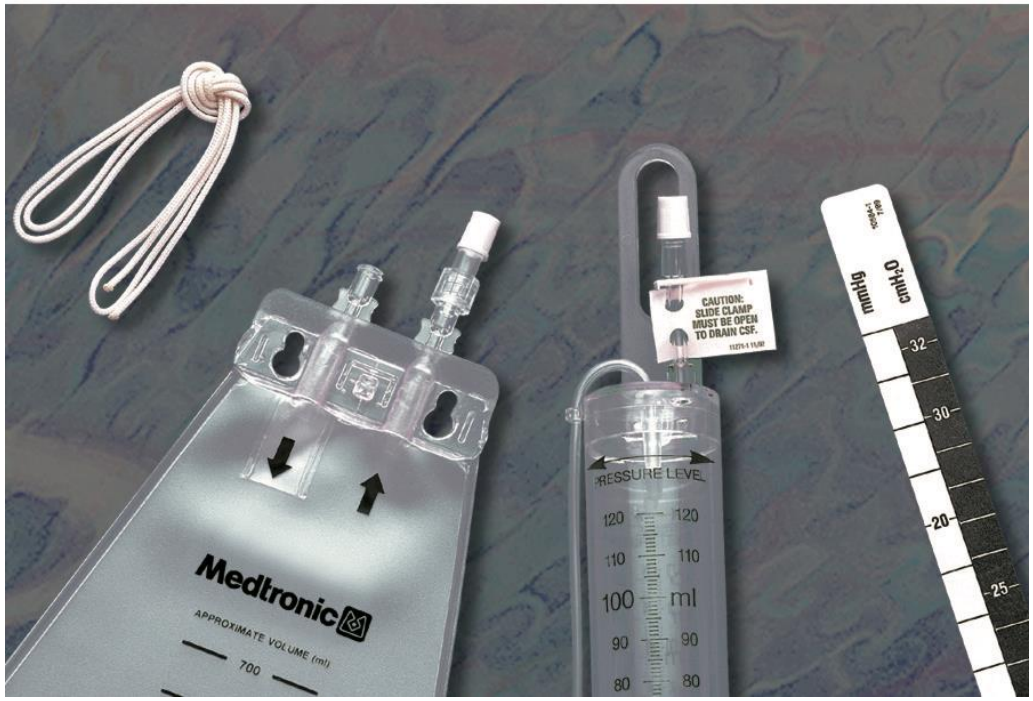
ПОКАЗАНИЯ К НВД

- Санация ликвора
- Профилактика осложнений (ЗЧЯ…)
- Жизнеугрожающая окклюзия
- Мониторинг/снижение ВЧД при ЧМТ и других “реанимационных” ситуациях

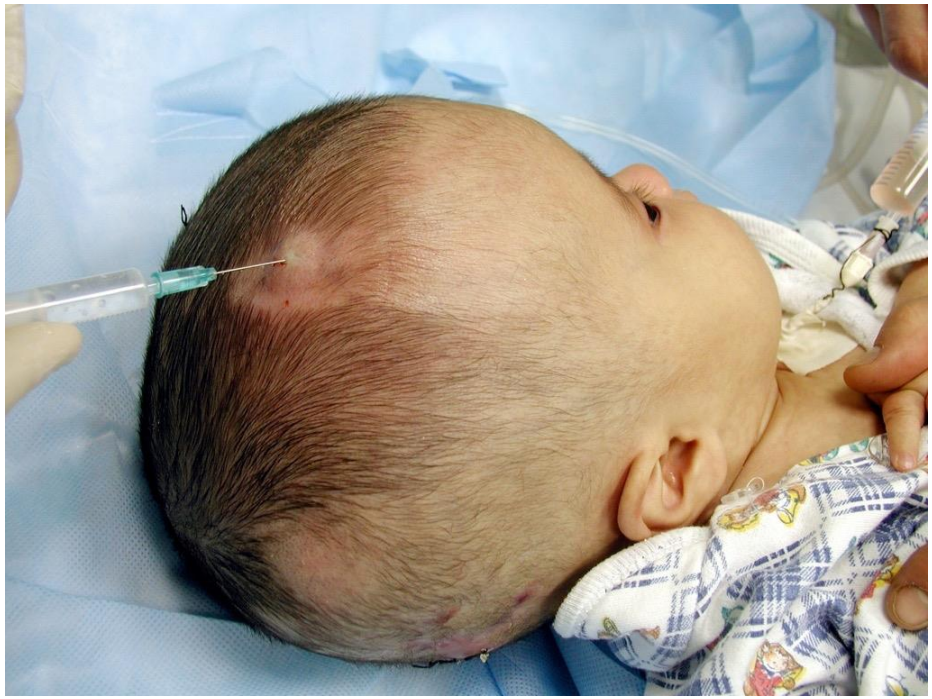
ПРОФИЛАКТИКА ИНФЕКЦИИ ПРИ НВД

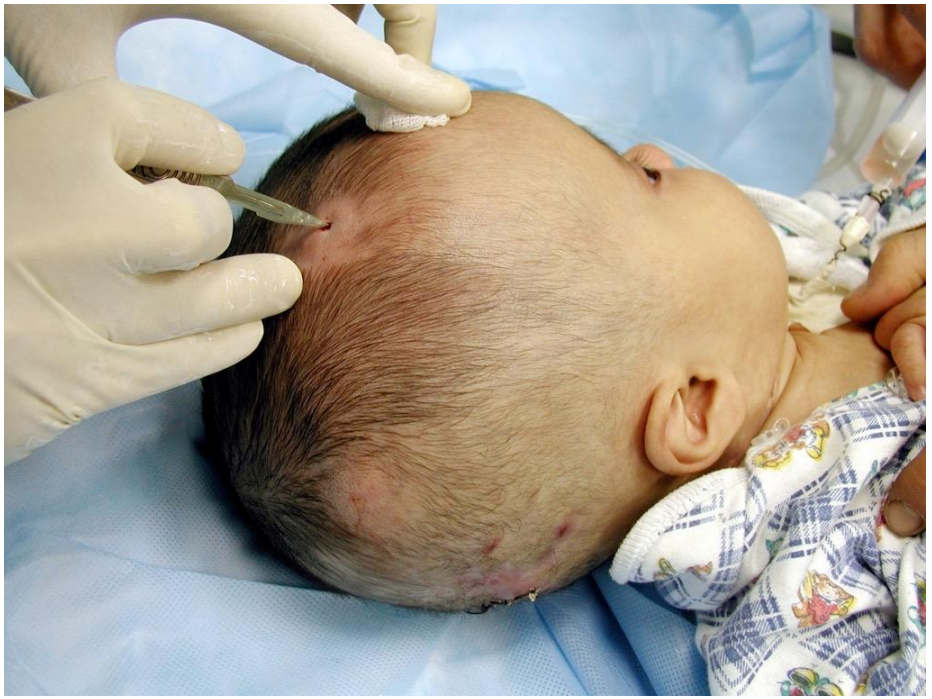
- АСЕПТИКА ПРИ УСТАНОВКЕ
- ТУННЕЛИРОВАНИЕ КАТЕТЕРА
- АБ-профилактика? ?

УСТАНОВКА НВД

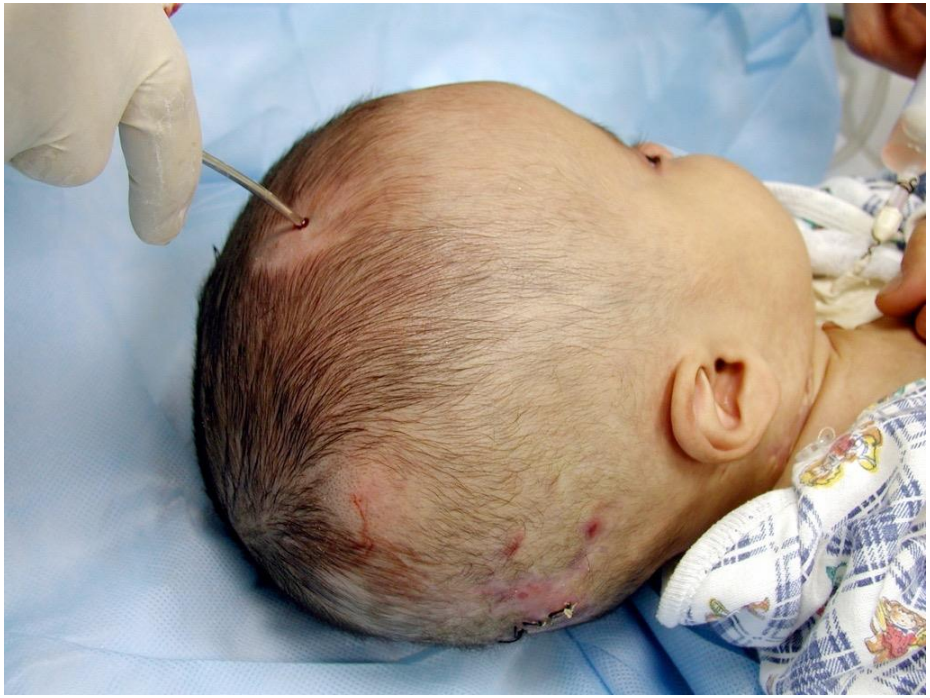


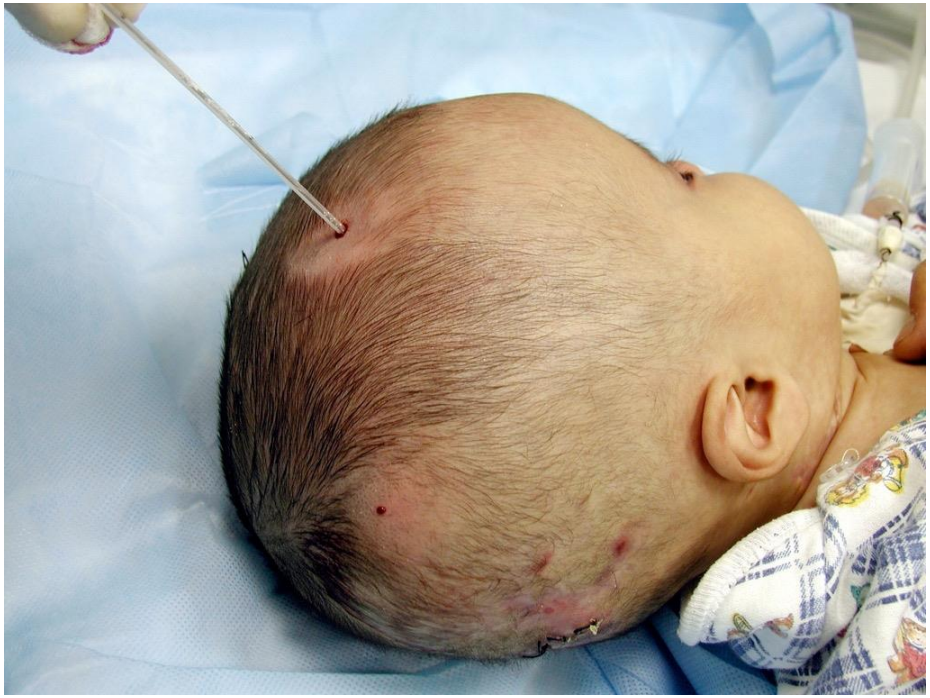
УСТАНОВКА НВД



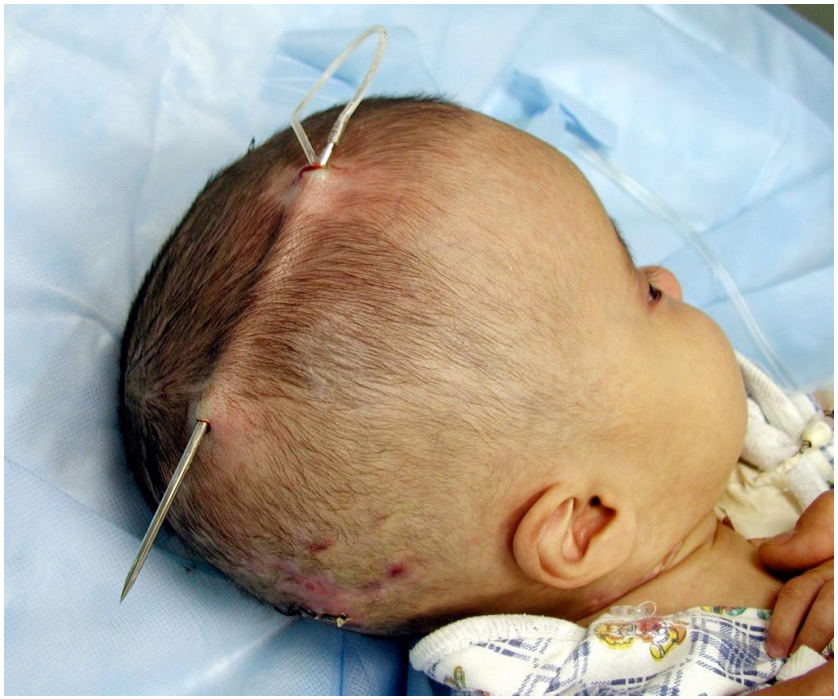


УСТАНОВКА НВД

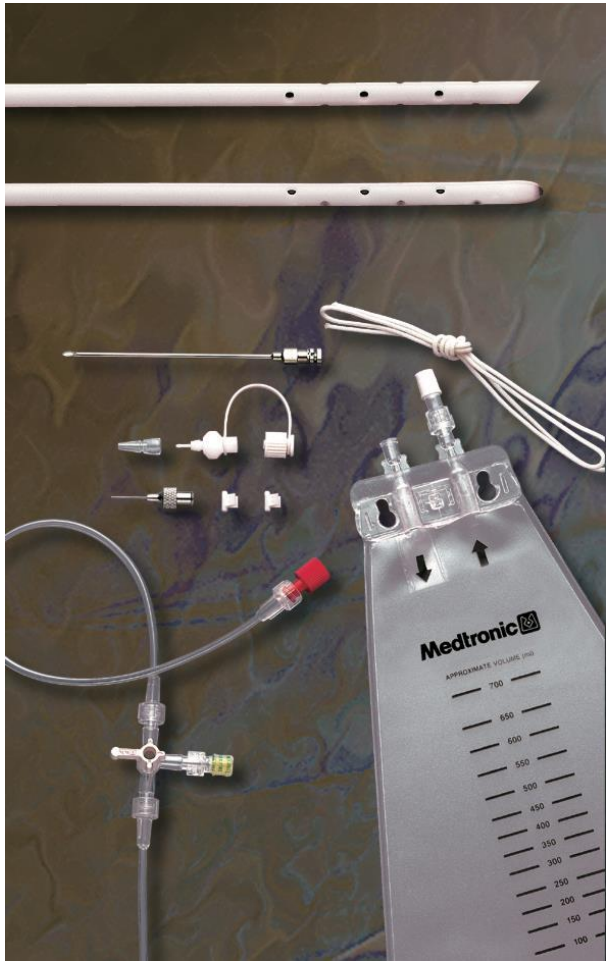


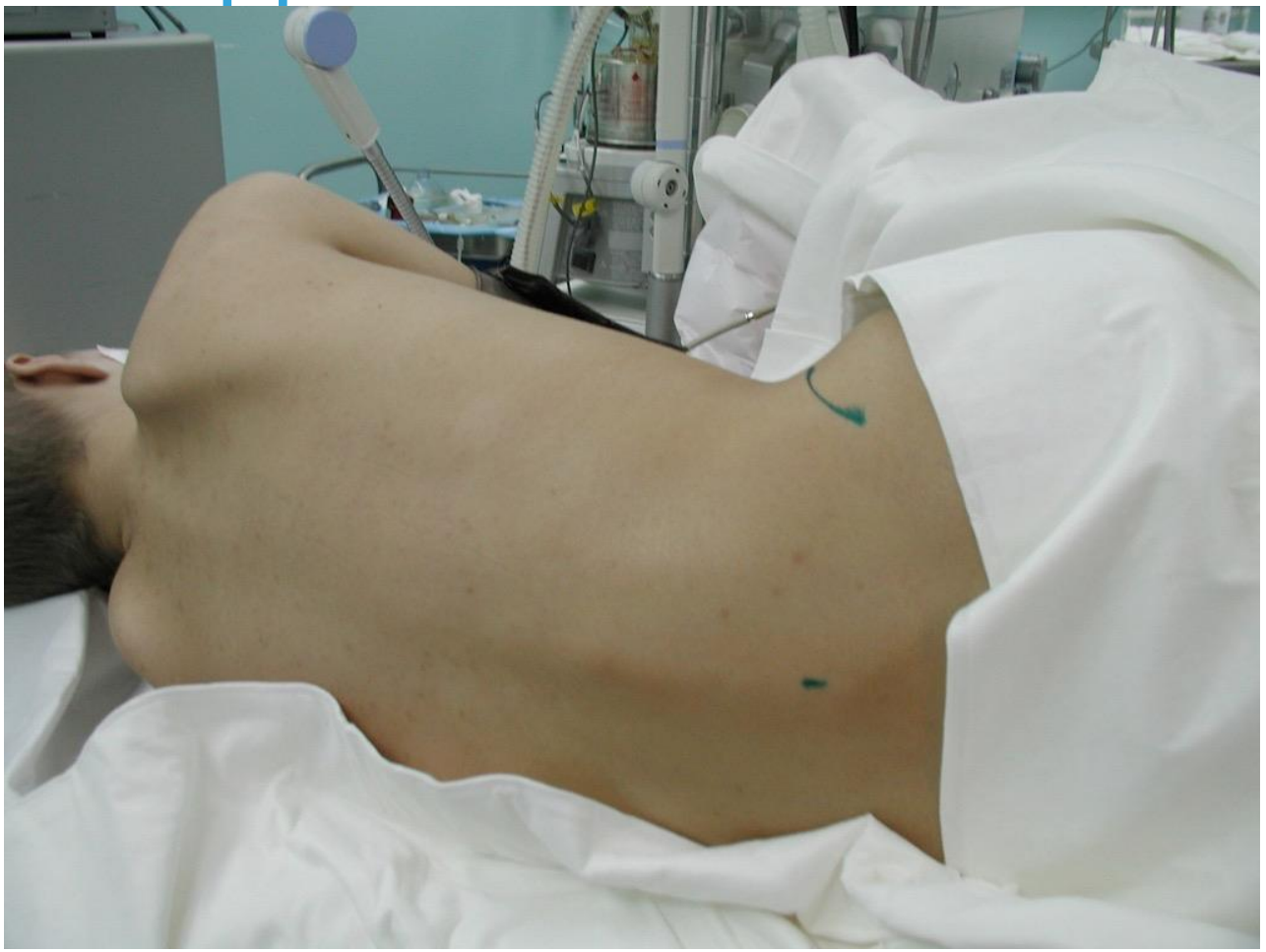


УСТАНОВКА НВД



УСТАНОВКА НЛД





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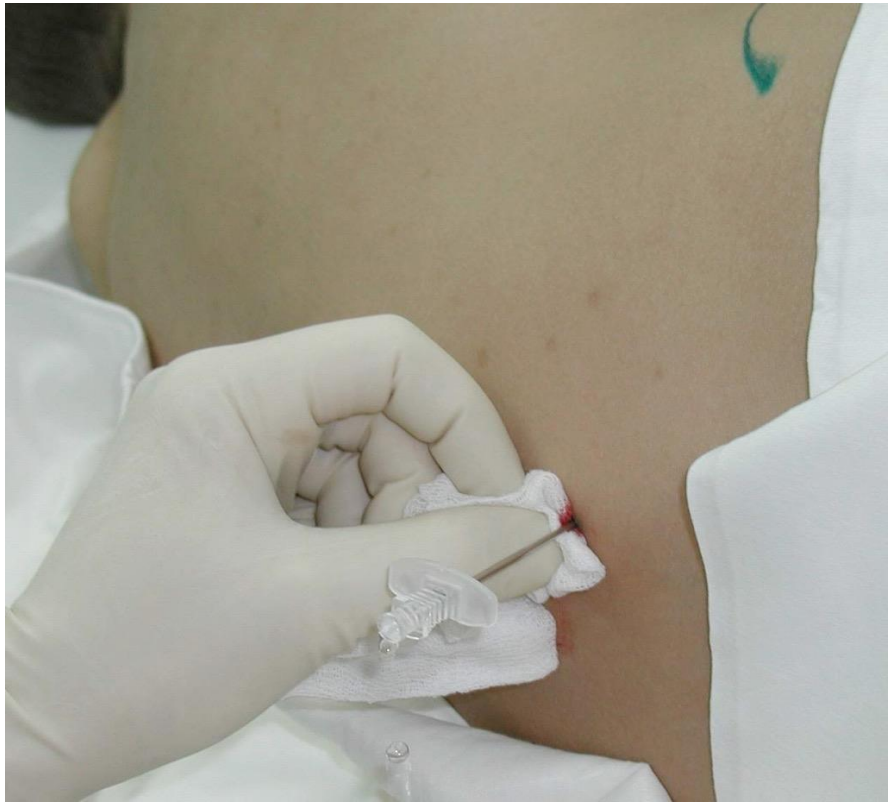

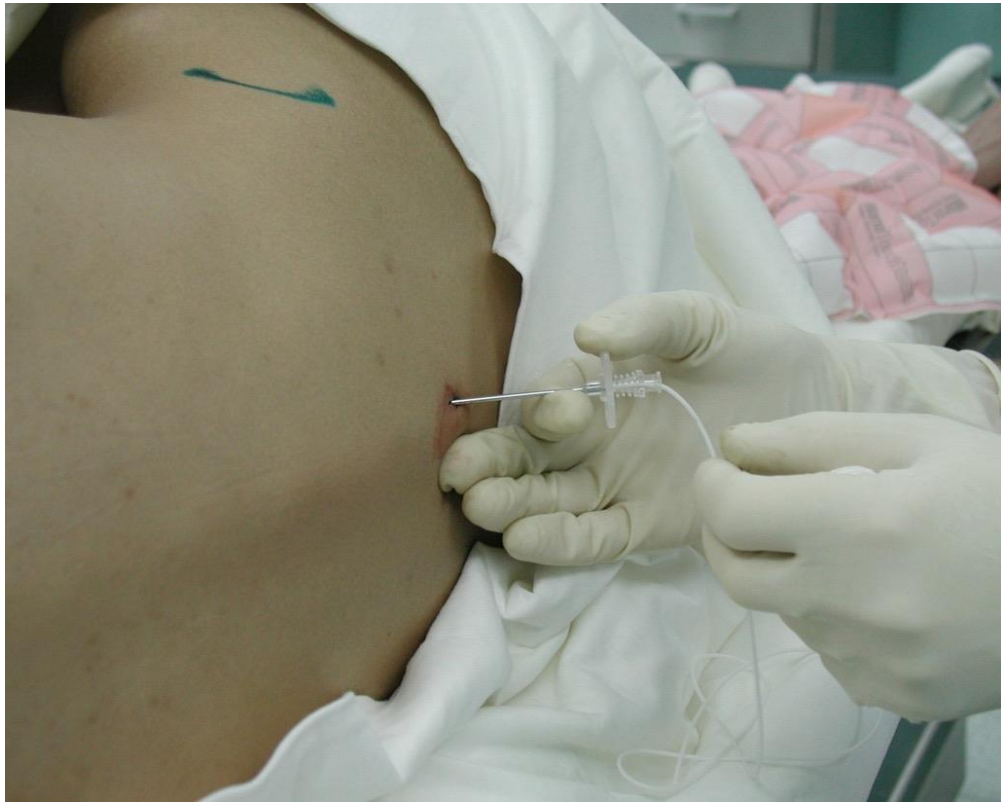

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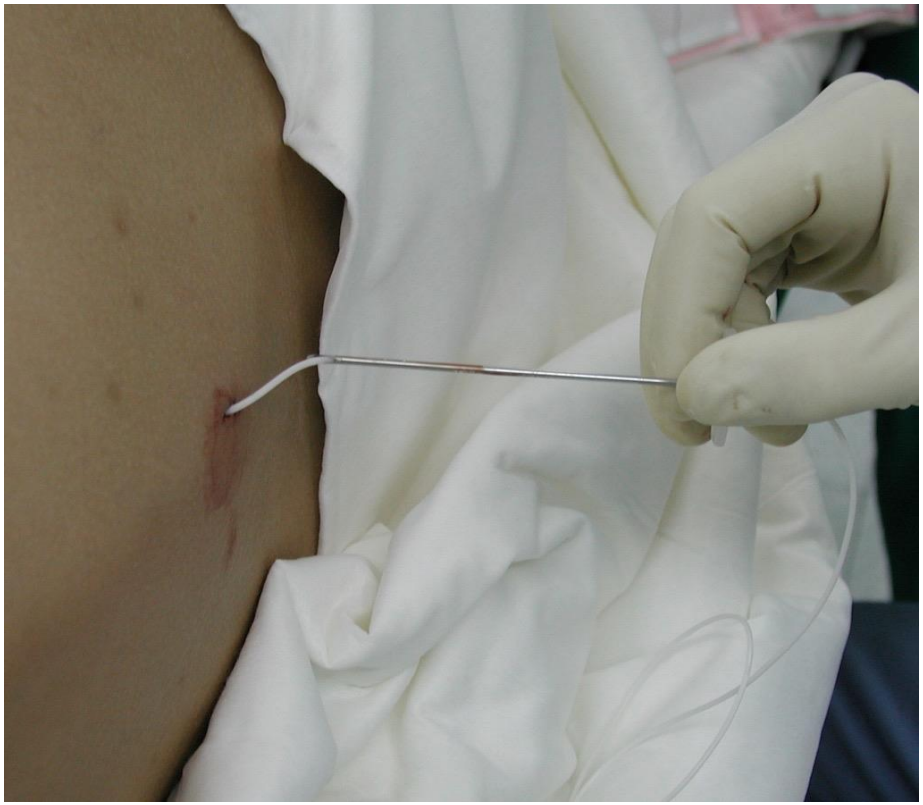

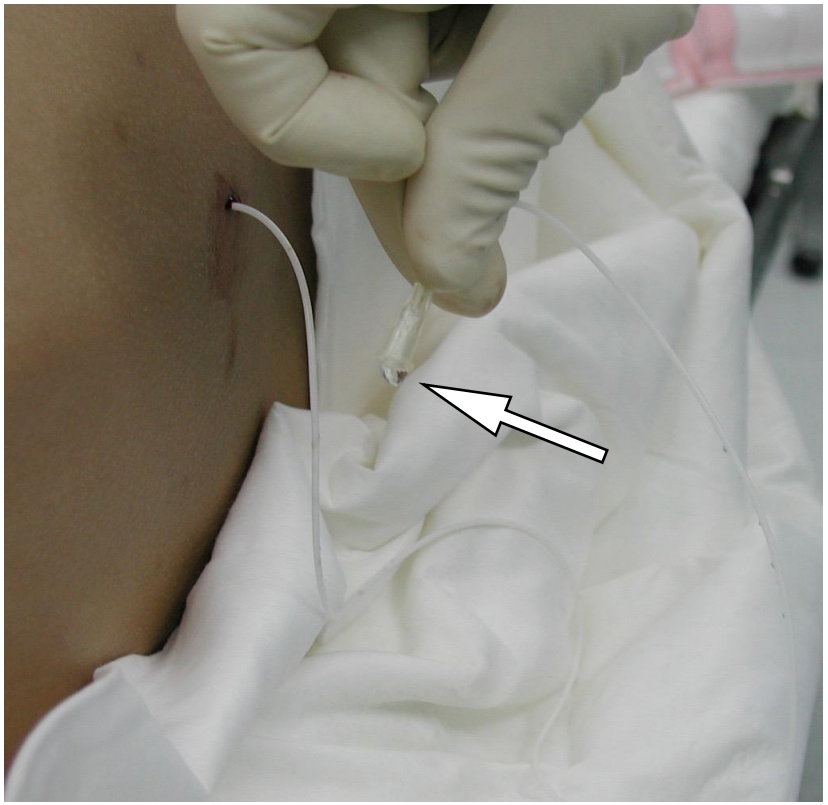

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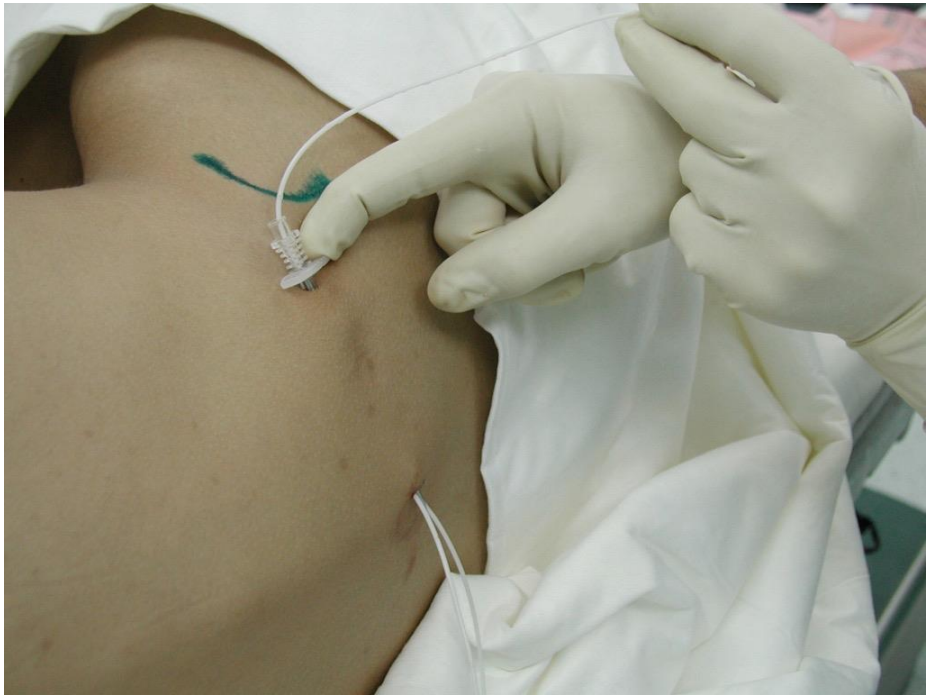
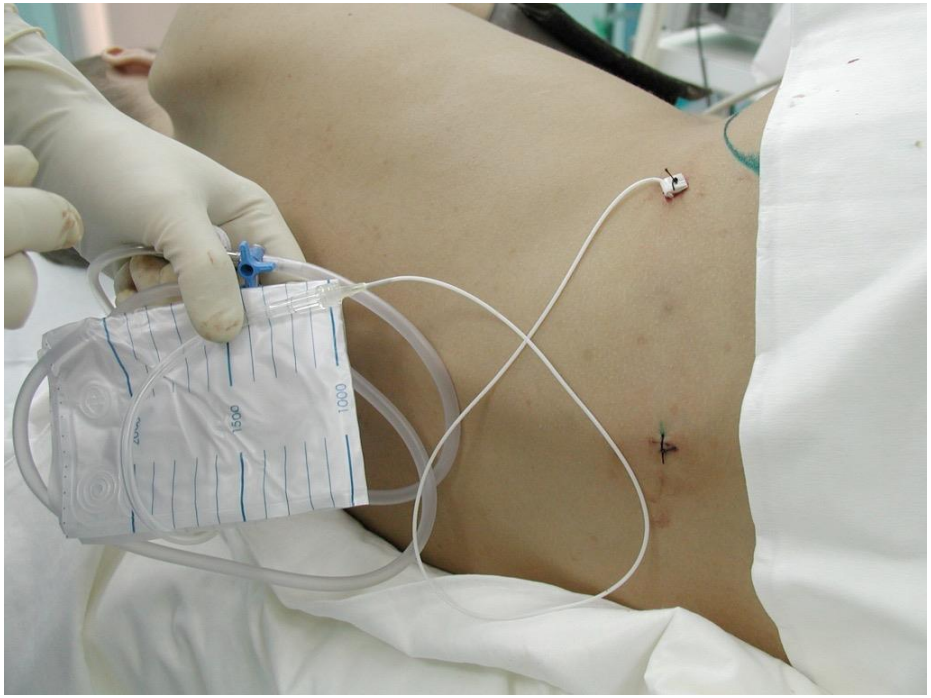




МЕСТО НОВЫХ ТЕХНОЛОГИЙ

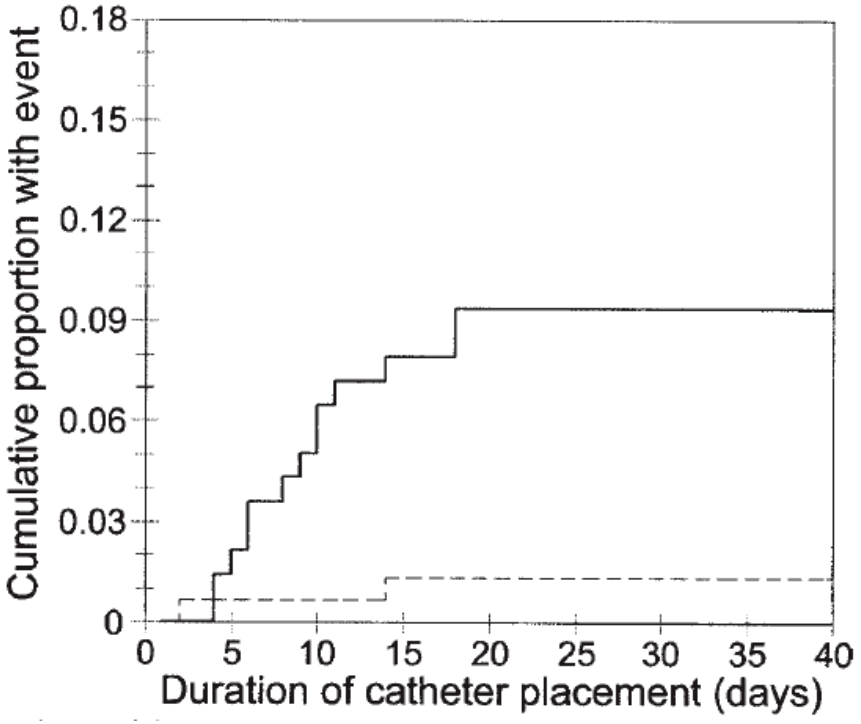
- AB-impregnation
- Silver-coated

AB-IMPREGNATION

Efficacy of antimicrobial-impregnated external ventricular drain catheters: a prospective, randomized, controlled trial

JOSEPH M. ZABRAMSKI, M.D., DONALD WHITING, M.D., RABIH O. DAROUICHE, M.D., TERRY G. HORNER, M.D., JEFFREY OLSON, M.D., CLAUDIA ROBERTSON, M.D., AND ALLAN J. HAMILTON, M.D.

J Neurosurg 98:725–730, 2003



SILVER-COATED

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The SILVER (Silver Impregnated Line Versus EVD Randomized Trial): A Double-Blind, Prospective, Randomized, Controlled Trial of an Intervention to Reduce the Rate of External Ventricular Drain Infection

BACKGROUND: Cerebrospinal fluid (CSF) infections associated with external ventricular drain (EVD) placement attract major consequences. Silver impregnation of catheters attempts to reduce infection.

OBJECTIVE: To assess the efficacy of silver catheters against CSF infection.

METHODS: We performed a randomized, controlled trial involving 2 neurosurgical centers (June 2005 to September 2009). A total of 356 patients requiring an EVD were assessed for eligibility; 325 patients were enrolled and randomized (167 plain, 158 silver); 278 patients were analyzed (140 plain, 138 silver). The primary outcome measure was CSF infection as defined by organisms seen on Gram stain or isolated by culture. Secondary outcome measures included ventriculoperitoneal (VP) shunting.

RESULTS: There was a significant difference in infection risk between the 2 study arms: 21.4% (30/140) for plain catheters vs 12.3% (17/138) for silver catheters ($P = .0427$; 95%

ШУНТ-ИНФЕКЦИЯ

ЛЮБЕЗНО ПРЕДОСТАВЛЕНА Ю.В.КУШЕЛЕМ

ОПРЕДЕЛЕНИЕ ПОНЯТИЯ*

- идентификация микроорганизма в культуре или в мазке из СМЖ, раны, абдоминальные псевдокисты
- “эрозия шунта”
- абдоминальная псевдокиста, даже при отрицательных посевах
- положительный посев крови у пациента с ВАШ

ЧАСТОТА У ДЕТЕЙ ≤ 10%

ПРОФИЛАКТИКА

QUALITY IMPROVEMENT METHODOLOGY - МЕТОДОЛОГИЯ УЛУЧШЕНИЕ КАЧЕСТВА

- разработка и применение стандартизированного пошагового протокола выполнения стандартных действий
- оценка “приверженности” к выполнению протокола
- оценка результатов применения протокола

J Neurosurg Pediatrics 8:22–29, 2011

A standardized protocol to reduce cerebrospinal fluid shunt infection: The Hydrocephalus Clinical Research Network Quality Improvement Initiative

Clinical article

John R. W. Kestle, M.D.,[1] Jay Riva-Cambrin, M.D.,[1] John C. Wellons III, M.D.,[2] Abhaya V. Kulkarni, M.D.,[3] William E. Whitehead, M.D.,[4] Marion L. Walker, M.D.,[1] W. Jerry Oakes, M.D.,[2] James M. Drake, M.B.Ch.B.,[3] Thomas G. Luerssen, M.D.,[4] Tamara D. Simon, M.D., M.S.P.H.,[5] and Richard Holubkov, Ph.D.,[6] for the Hydrocephalus Clinical Research Network

[1]Primary Children's Medical Center, University of Utah, Salt Lake City, Utah; [2]Birmingham Children's Hospital, University of Alabama, Birmingham, Alabama; [3]Hospital for Sick Children, University of Toronto, Ontario, Canada; [4]Texas Children's Hospital, Baylor College of Medicine, Houston, Texas; [5]Seattle Children's Research Institute, University of Washington, Seattle, Washington; and [6]Hydrocephalus Clinical Research Network Data Coordinating Center, Department of Pediatrics, University of Utah, Salt Lake City, Utah

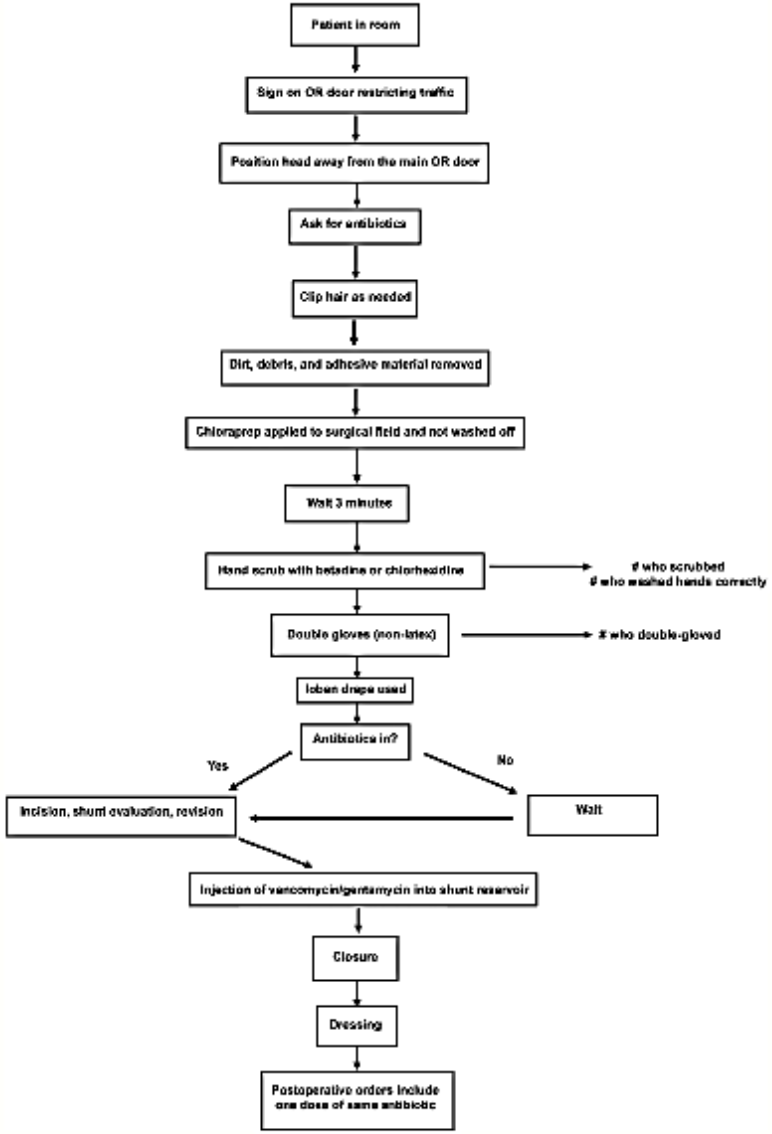

FIG. 1. Diagram showing the HCRN shunt surgery protocol. In the step requiring the surgeon to ask for antibiotics, the surgeon requests that intravenous cefazolin (30 mg/kg) be given before making the first incision. In patients allergic to cephalosporins, vancomycin (15 mg/kg) is used. When the patient's hair is clipped, the hair is removed using clippers in the region of the incision as per the surgeon's usual practice. The shunt equipment selected for shunt insertion or revision is selected by the surgeon, except that antibiotic-impregnated shunts were not allowed. After the shunt procedure and prior to closure, 1 ml (10 mg/ml) of vancomycin mixed with 2 ml (2 mg/ml) of gentamicin is injected into the shunt reservoir with a 25-gauge needle (or smaller). In patients with a prior adverse reaction to vancomycin, the gentamicin is given alone. For this study, procedures in which vancomycin was not used were counted as noncompliant.

HCRN QUALITY IMPROVEMENT PROTOCOL RESULTS

Methods: The protocol was developed sequentially by HCRN members using the current literature and prior institutional experience until consensus was obtained.

Results. Twenty-one surgeons at 4 centres performed 1571 procedures between June 1, 2007, and February 28, 2009. The minimum follow-up was 6 months. The Network infection rate decreased from 8.8% prior to the protocol to 5.7% while using the protocol ($p = 0.0028$, absolute risk reduction 3.15%, relative risk reduction 36%). Three of 4 centres lowered their infection rate….

Overall protocol compliance was 74.5% and improved over the course of the observation period

АБ-ИМПРЕГНИРОВАННЫЕ ИЗДЕЛИЯ

- катетеры
- шовный материал (VicrylPlus, triclosan)

ПРОФИЛАКТИКА

- Klimo P.J., Thompson C.J., Ragel B.T., Boop F.A. Antibiotic-impregnated shunt systems versus standard shunt systems: a meta- and cost-savings analysis. J Neurosurg Pediatr 2011; 8: 600-612.

OBJECT: ….For studies that demonstrated a positive effect with the AIS, a cost-savings analysis was conducted by calculating the number of implanted shunts needed to prevent a shunt infection, assuming an additional cost of $400 per AIS system and $50,000 to treat a shunt infection. RESULTS: Thirteen prospective or retrospective controlled cohort studies provided Level III evidence, and 1 prospective randomized study provided Level II evidence…There were 390 infections (7.0%) in 5582 procedures in the control group and 120 infections (3.5%) in 3467 operations in the treatment group, yielding a pooled absolute risk reduction (ARR) and relative risk reduction (RRR) of 3.5% and 50%, respectively. The meta-analysis revealed the AIS to be statistically protective in all studies (risk ratio = 0.46, 95% CI 0.33-0.63) and in single-institution studies (risk ratio = 0.38, 95% CI 0.25-0.58)… Seven studies showed the AIS to be statistically protective against infection with an ARR and RRR ranging from 1.7% to 14.2% and 34% to 84%, respectively. The number of shunt operations requiring an AIS to prevent 1 shunt infection ranged from 7 to 59. Assuming 200 shunt cases per year, the annual savings for converting from SSs to AISs ranged from $90,000 to over $1.3 million. CONCLUSIONS: …this meta-analysis revealed a significant protective benefit with AIS systems, which translated into substantial hospital savings despite the added cost of an AIS…

ПРОФИЛАКТИКА

- Rozzelle C.J., Leonardo J., Li V. Antimicrobial suture wound closure for cerebrospinal fluid shunt surgery: a prospective, double-blinded, randomized controlled trial. J Neurosurg Pediatr 2008; 2: 111-117.

OBJECT: …The authors prospectively evaluated the incidence of CSF shunt infection following shunt procedures performed using either antimicrobial suture (AMS) or conventional suture. METHODS: In a single-center, prospective, double-blinded, randomized controlled trial, the authors enrolled 61 patients, among whom 84 CSF shunt procedures were performed over 21 months. Randomization to the study (AMS) or control (placebo) group was stratified to minimize the effect of known shunt infection risk factors on the findings. Antibacterial shunt components were not used. The primary outcome measure was the incidence of shunt infection within 6 months of surgery. RESULTS: The shunt infection rate in the study group was 2 (4.3%) of 46 procedures and 8 (21%) of 38 procedures in the control group ($p = 0.038$). There were no statistically significant differences in shunt infection risk factors between the groups (procedure type and time, age < 6 months, weight < 4 kg, recent history of shunt infection). No suture-related adverse events were reported in either group. CONCLUSIONS: These results support the suggestion that the use of AMS for CSF shunt surgery wound closure is safe, effective, and may be associated with a reduced risk of postoperative shunt infection. A larger randomized controlled trial is needed to confirm this association.

ШУНТ -ИНФЕКЦИЯ

ВАРИАНТЫ ПОВЕДЕНИЯ ХИРУРГА

- АБ-терапия без удаления шунта
- экстернализация шунта + АБ-терапия
- удаление шунта (НВД) + АБ-терапия
- переустановка шунта + АБ-терапия

ЛЕЧЕНИЕ

- Удаление шунта - гарантия успеха в лечении шунт-инфекции

James H.E., Walsh J.W., Wilson H.D., Connor J.D., Bean J.R., Tibbs P.A. Prospective randomized study of therapy in cerebrospinal fluid shunt infection. Neurosurgery 1980; 7: 459-463.

ПЕРСПЕКТИВЫ

СНИЖЕНИЕ ЧАСТОТЫ ШУНТ-ИНФЕКЦИИ

- внедрение и, высокая приверженность к соблюдению протокола операции
- разработка новых материалов, снижение стоимости существующих АБ-импрегнированных шунтов

PERHAPS THE BEST STRATEGY TO TREAT VENT SHUNT INFECTION IS TO CONTINUE OUR FOCUS ON THE PREVENTION OF THIS SIGNIFICANT COMPLICATION OF CSF SHUNT SURGERY

M.S.Tumber et al. Management of CSF shunt infection. 2014

НАШ САЙТ

NSICU.RU

НИИ нейрохирургии
им.Бурденко РАМН