Case Report

Successful Medical Treatment in a Child with *E. Coli* ESBL Meningitis with Acute Communicating Hydrocephalus and Ventricular Empyema: A Case report

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Extended-spectrum beta-lactamase (ESBL) producing organisms cause wide spectrum of diseases including urinary tract infection, cholangitis, intra-abdominal abscess or pneumonia but rarely meningitis. The present report a successful non-surgical, medical treatment in a child with Escherichia coli ESBL meningitis with acute symptomatic communicating hydrocephalus and ventricular empyema. Incidence of infections from ESBL producing organisms are increasingly emerging and causing wide spectrum of illnesses which prompts for both aggressive medical and surgical intervention to prevent morbidity and mortality. Antimicrobial agents must be vigilantly utilized to prevent possible development of new highly-resistant organisms.

Keywords: *Extended-spectrum beta-lactamase (ESBL), Escherichia coli, Meningitis*

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Extended-spectrum beta-lactamase (ESBL) producing organisms are increasingly emerging and implicating an outbreak in both community and hospital settings[1]. ESBL are mostly reported in *Klebsiella pneumoniae* and *Escherichia coli*[2]. Due to its properties of resistance, the choices of antimicrobials are limited, thus posing high rates of morbidity and mortality.

ESBL producing organisms cause wide spectrum of diseases including urinary tract infection, cholangitis, intra-abdominal abscess or pneumonia but rarely meningitis[3]. Patients with meningitis can be complicated with ventriculitis, brain abscess and acute hydrocephalus with cerebral herniation, requiring prompt surgical intervention[4,5]. The authors report a successful non-surgical, medical treatment in a child with *E. coli* ESBL meningitis with acute symptomatic communicating hydrocephalus and ventricular empyema.

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Case Report

An eight-month-old boy with multiple anomalies of ophthalmic dermoid tumour, cleft lip, cleft palate, polydactyly, bifid vertebra and right ear pinna anomalies presented to our hospital with one day of fever and mucous diarrhea. His chromosome study and cranial ultrasonography were normal. He never had seizure nor on any anti-epileptic drugs. On admission, his vital signs were normal and other physical examinations were unremarkable aside from signs of mild dehydration. He was diagnosed with infectious diarrhea and intravenous ceftriaxone was initiated with gradual improvement of diarrhea. The stool culture was negative for the enteropathogenic organisms.

On the third day of admission, he developed generalized tonic-clonic seizure with alteration of sensorium. Physical examinations revealed spiking fever of 39°C with bulging anterior fontanelle and positive Brudzinski's sign without focal neurological deficits. Lumbar puncture was promptly performed and revealed cloudy cerebrospinal fluids (CSF) with white blood cells of 16,560 cells/mm^3 (99% polymorphonuclear cells), red blood cells of 2 cells/mm^3, protein of 279 mg/dL and sugar < 2 mg/dL (blood sugar 88 mg/dL). CSF gram stain demonstrated numerous gram negative bacilli. Diagnosis of bacterial meningitis was made and

antibiotics were empirically switched to high dose intravenous cefotaxime. Intravenous phenytoin was loaded and maintained in attempt to control seizure.

After three days of treatment, the patient developed recurrent seizures despite administration of anti-epileptic drug with decremented sensorium. Endotracheal intubation was placed and cerebral computed tomography (CT) was performed. CT demonstrated marked hydrocephalus with isodensed fluid debris with fluid-fluid level in both lateral ventricles, suggestive of communicating hydrocephalus with hyperproteinaceous fluid such that of ventricular empyema. His CSF culture revealed *E. coli* ESBL, antibiotic was then switched to meropenem with regular lumbar puncture. After three days of antibiotic treatment, lumbar puncture failed to release the pressure, thus neurosurgical consultation was made for acute, symptomatic hydrocephalus and ventricular empyema. After discussion with the parents concerning possible complications of surgery and treatment choices, the parents did not consent to surgical intervention (ventriculostomy) with preference to antimicrobials treatment. After treatment installation, gradual improvement was observed in both sensorium and CSF profile (Table 1). CSF culture was negative for organisms after 10 days of treatment. Meropenem was continued for 42 days. His sensorium and CSF profile returned to normal before stopping the antibiotic. Serial CT showed improvement of hydrocephalus. Phenytoin was stopped with no recurrent seizure. Nevertheless, the patient was never extubated and tracheostomy was done due to recurrent aspiration pneumonia and hypersecretion. He is currently supervised by pediatric neurologist and pulmonologist.

Discussion

The authors reported a child with *E. coli* ESBL meningitis without history of neurosurgical procedures. Although this patient had multiple anomalies including bifid vertebra, there was no evidence of connection between subarachnoid space to the external environment. Further investigations revealed acute communicating hydrocephalus with ventricular empyema, which was successfully treated with intravenous antibiotics without surgical intervention.

Due to widespread utilization of third generation cephalosporins, the incidence of infection from extended-spectrum beta-lactamase organisms is increasing[1-3]. Reports in Southeast Asian countries showed that most common organisms producing such properties include *Klebsiella pneumoniae* and *E. coli*, ranging from 5-30% of all isolates[6]. Data in Thailand also revealed similar incidence of infection, ranging from 15-33%[1,2,7]. Due to its properties of resistance to beta-lactam antimicrobials, the choices of antimicrobials are limited, posing high rates of morbidity and mortality[8,9]. In one report of ESBL outbreaks in neonatal unit in Mexico, the mortality rate was as high as 66%[9].

Arrays of diseases include urinary tract infection, cholangitis, intra-abdominal abscesses and pneumonia. Meningitis was rarely reported unless in patients with history of neurosurgery[3]. Nevertheless, meningitis can be highly morbid with possible complications of ventriculitis, brain abscess and hydrocephalus with cerebral herniation which required surgical intervention[4,5].

Incidence of infections from ESBL producing organisms are increasingly emerging and causing wide

Table 1. Cerebrospinal fluid profile in a child with *E. coli* ESBL meningitis, communicating hydrocephalus and ventricular empyema

	Day 1	Day 3	Day 10	Day 14	Day 30	Day 42
Total cells (cells/mm^3)	16,562	256,800	27,020	18,100	8,080	9
WBC (cells/mm^3)	16,560	124,200	3,840	100	80	4
RBC (cells/mm^3)	2	132,600	23,180	18,000	8,000	5
Polymorphs (%)	99	97	91	90	36	Too low to differentiate
Mononuclear cells (%)	1	3	9	10	64	Too low to differentiate
Protein (mg/dL)	279	286.6	484.3	93.1	90.2	27.6
Sugar (Blood sugar) (mg/dL)	< 2 (88)	< 2 (50)	17 (74)	16 (96)	32 (76)	46
Gram stain	Numerous gram negative bacilli	Numerous gram negative bacilli	Negative for organism	Negative for organism	Negative for organism	Negative for organism
Culture	*E. coli* ESBL	*E. coli* ESBL	No growth	No growth	No growth	No growth

spectrum of illnesses which prompts for both aggressive medical and surgical intervention to prevent morbidity and mortality. Antimicrobial agents must be vigilantly utilized to prevent possible development of new highly-resistant organisms.

In conclusion, the medical treatment of a child with *E. coli* ESBL meningitis complicating with communicating hydrocephalus and ventricular empyema is achievable with regular lumbar puncture and appropriate antibiotic therapy.

Potential conflicts of interest

None.

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รายงานผู้ป่วย 1 รายที่ป่วยด้วยโรคเยื่อหุ้มสมองอักเสบชนิดรุนแรงในเด็กจากเชื้ออีโคไลสายพันธุ์ที่สร้างเอนไซม์อีเอสบีแอลที่รักษาสำเร็จด้วยยาปฏิชีวนะ

ชนะภัย ไชยกุลศิลป์, โอฬาร พรหมาลิขิต

เชื้อแบคทีเรียสายพันธุ์ที่สร้างเอนไซม์อีเอสบีแอลเป็นสาเหตุของการติดเชื้อที่พบบ่อยได้แก่ การติดเชื้อของระบบทางเดินปัสสาวะ การติดเชื้อของท่อน้ำดี ฝีในช่องท้อง และปอดอักเสบ แต่พบเป็นสาเหตุของเยื่อหุ้มสมองอักเสบได้น้อย รายงานผู้ป่วยเด็ก 1 ราย ได้รับการวินิจฉัยเยื่อหุ้มสมองอักเสบจากเชื้ออีโคไลสายพันธุ์ที่สร้างเอนไซม์อีเอสบีแอลและมีข้อแทรกซ้อนได้แก่ communicating hydrocephalus และ ventricular empyema ผู้ป่วยได้รับการรักษาด้วยยาปฏิชีวนะร่วมกับการเจาะระบายน้ำไขสันหลังจนหายเป็นปกติ เนื่องจากเชื้อแบคทีเรียสายพันธุ์ที่สร้างเอนไซม์อีเอสบีแอลพบเป็นสาเหตุของการติดเชื้อในโรงพยาบาลเพิ่มมากขึ้น และมักก่อให้เกิดการติดเชื้อได้หลายระบบในร่างกายซึ่งอาจต้องใช้การรักษาที่ยุ่งยาก มีราคาแพง ทั้งในด้าน อายุรกรรมและศัลยกรรม ดังนั้นจึงควรมีมาตรการการควบคุมการใช้ยาปฏิชีวนะในโรงพยาบาลให้เหมาะสมเพื่อลดอุบัติการณ์ของการเกิดเชื้อแบคทีเรียดื้อยาเหล่านี้