International Journal of Pediatric Otorhinolaryngology 78 (2014) 577–582

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: www.elsevier.com/locate/ijporl

Review Article

Deep neck abscess in neonatal period: Case report and review of literature

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ARTICLE INFO

Article history:
Received 12 November 2013
Received in revised form 8 January 2014
Accepted 11 January 2014
Available online 23 January 2014

Keywords:
Deep neck abscess
Neonate
Staphylococcus aureus

ABSTRACT

Deep neck abscess is very rare in neonatal period. We reported a deep neck abscess caused by methicillin-sensitive *Staphylococcus aureus* infection (MSSA) in a neonate. A 10-day male infant was admitted to our neonatal unit with the complaints of fever, irritability, and refused to food intake. Ultrasonography and magnetic resonance imaging revealed as an abscess in the neck. Needle aspiration from abscess revealed pus. Antibiotics and drainage were applied. We also reviewed the neonatal deep neck abscess reported in English literature and clinical presentation, risk factors, causing microorganisms, treatment, complication and outcome of deep neck abscesses were discussed.

Contents

1. Introduction

A deep neck abscess is defined as a collection of pus in the facial planes and spaces of the head and neck and it can lead to life-threatening complications. Deep neck abscesses are rare in neonatal period [1–16]. Herein, we describe a deep neck abscess, presented as neonatal sepsis, caused by methicillin-sensitive *Staphylococcus aureus* (MSSA) in a neonate. In addition, cases with deep neck abscess reported in the neonatal period in English literature were reviewed.

2. Case report

A 10-day male neonate was referred to our unit with the complaints of fever, irritability, and poor feeding. The infant was born by vaginal delivery after 40 weeks of pregnancy with 3.330 g birth weight. There was no history of birth trauma and invasive procedure. At admission, physical examination revealed the fever: 40.2 °C, heart rate: 186 bpm, respiratory rate: 68 bpm, capillary refill time 4 s, cutis marmoratus, mild jaundice, and the other physical examination findings were normal. The chest radiograph was clear. Initial laboratory examination revealed hemoglobin 14.8 g/dL, white blood cells $24 \times 10^3/\mu L$ and thrombocytes $279 \times 10^3/\mu L$. Toxic granulation was observed on blood smear examination and immature/total neutrophil ratio was 0.2. C-reactive protein level was 83.2 mg/L (normal range: 0–8 mg/L). A lumbar puncture was performed, and there were no white blood cells in cerebrospinal fluid on direct microscopic examination, protein and glucose levels in cerebrospinal fluid (CSF) were 71.2 mg/dL and 72 mg/dL, respectively. Blood, urine and CSF cultures were obtained. He was hospitalized with diagnosis of neonatal sepsis and intravenous vancomycin and cefotaxime were started. After one day of hospitalization, neck swelling was observed (Fig. 1). Ultrasonography revealed that abscess. Magnetic

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0165-5876/$ – see front matter © 2014 Elsevier Ireland Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ijporl.2014.01.015

Fig. 1. It shows neck swelling on the right side of the neonate.

resonance imaging (MRI) was performed on the second day of admission and revealed a 36 mm × 26 mm × 37 mm right sided, large multiloculated mass spreading to lateral pharyngeal recess (Fig. 2A). The mass was peripherally enhancing after intravenous Gadovist infusion (Fig. 2B). Needle aspiration from abscess revealed pus. The MSSA was grown in purulent material. Blood, urine and CSF cultures were sterile. Cefotaxime and vancomycin were stopped and continued first generation cephalosporin for 14 days. The resolution of abscess was shown on ultrasound and there has not been recurrence. The patient was discharged after 14 days of hospitalization in good clinical condition and without any findings in the neck examination.

3. Discussion

In this manuscript, we report a newborn with deep neck abscesses caused by MSSA infection successfully managed with antibiotics and drainage. In addition, neonatal cases with deep neck abscess reported in English literature were reviewed and clinical presentation, risk factors, causing microorganisms, treatment, complication and outcome of deep neck abscesses were discussed (Table 1).

Although antibiotics therapy has reduced the incidence of deep neck abscess, it remains an important clinical problem because of serous life-threatening complications. Although many investigations about deep neck abscess have been reported in childhood, it has been rarely reported in neonatal period, usually as a case report. Deep neck abscess has been more reported in male newborns and male:female ratio is 2:1 [1,3,4,6,7,9–16]. Most cases do not have any risk factors for deep neck abscess [3,4,6,7,10,12–16], while some cases have predisposing factors such as endotracheal intubation, application of nasopharyngeal continuous positive airway pressure, multiple laryngoscopies, application of suction catheters, congenital malformations (third branchial arch remand or sinus, cystic hygroma) [1,5,6,8,9,11]. If recurrent retropharyngeal abscess occurs, congenital abnormality should be investigated [6]. Our case has no predisposing factors for deep neck abscess.

The most common clinical presentation of the deep neck abscesses is neck swelling, feeding and respiratory problems in neonatal period [1–16]. The clinical presentation of deep neck abscesses at diagnosis included neck swelling [2,3,6,8,9,12–16], fever [3,7,9,11,14–16], feeding problems (dysphagia, poor feeding, regürtitation of the feeds through nose, sialorrhea) [2,3,6,7,9,11,14–16], respiratory problems (tachypnea, stridor, cyanosis, horse crying, grunting and noisy breathing, apneic spells) [1–4,6,9–13,16], central neural system problems (irritability, paraplegia, lethargy, hypotonia in the upper limb) [3,6,7,15], cardiovascular system problems (bradicardia or tachycardia) [8,9]. Some cases with deep neck abscesses may be afebrile [1,2,6,8,10,11]. Our cases presented with fever, irritability, and poor feeding. Neck swelling was observed after one day of hospitalization.

Retropharyngeal mass may be showed on a radiograph [1,2,5,9]. Appearance of widening of the retropharyngeal space and reduction of gas image in the retropharyngeal space on lateral film of the neck may be an evidence of deep neck abscesses. Coulthard and Isaacs [6] have been reported that lateral of the neck had an 88% sensitivity in diagnosis of retropharyngeal abscess. Ultrasonography can be used for both diagnosis and sonographically guided aspiration of the mass [1]. Abscess, cystic hygroma, goiter, neuronal tumor, encephalocel, hematoma, hemangioma, branchial cleft remand can be seen in retropharyngeal space [1]. Cystic or solid masses can be differentiated with the use of ultrasonography [1]. Computerized tomography (CT) or MRI is the best modalities for diagnosis of deep neck abscesses and complications [4,7,10–16]. In our case, ultrasonography and MRI were used for diagnosis.

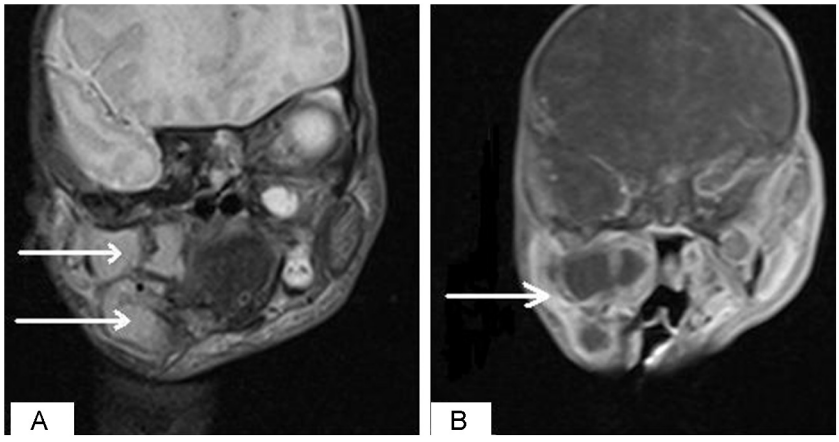

Fig. 2. MRI shows large multiloculated mass spreading to lateral pharyngeal recess (A) and peripherally enhancing after intravenous Gadovist infusion (B).

Table 1
Deep neck infection in neonatal period.

Author (published year)	Gender	Age at diagnosis	Predisposing factors	Clinical presentation	Localization of abscess	Isolated pathogens	Treatment	Complications	Outcome
1. Smith (1982)	Female	26 days	Third branchial arch remand	Stridor, tachypnea, apneic spells	Retropharyngeal	Cultures negative	Antibiotics and drainage		Uneventful recovery
2. Smith (1982)	Male	6 days	Cystic hygroma	Stridor, tachypnea	Retropharyngeal	Group B streptococcus (from blood)	Antibiotics and drainage		Uneventful recovery
3. Ravindra (1983)	NA	6 days	NA	Stridor, dysphagia, lateral cervical swelling	Lateral cervical	*Staphylococcus aureus* (from aspirate)	Antibiotics and drainage	–	Uneventful recovery
4. Asmar (1987)	Female	9 days	None	Fever, irritability and noisy breathing, submandibular swelling	Retropharyngeal	Group B streptococcus (from blood and aspirate)	Antibiotics and drainage	–	Uneventful recovery
5. Asmar (1987)	Male	18 days	None	Fever, poor feeding, irritability, noisy breathing, grunting	Retropharyngeal	Group B streptococcus (from blood)	Antibiotics	–	Uneventful recovery
6. Machida (1987)	Male	3 days	None	Respiratory distress (tachypnea, retractions, cyanosis)	Posterior-lateral pharyngeal	Group D enterococci (from blood), gamma streptococcus and *Escherichia coli* (from aspirate)	Antibiotics and drainage	Compression of the airway	Uneventful recovery
7. Morrison (1988)	NA	NA	Endotracheal intubation/suction catheter	NA	Retropharyngeal	*Escherichia coli* (from blood and aspirate)	Antibiotics and drainage	Perforation	Uneventful recovery
8. Morrison (1988)	NA	NA	Multiple laryngoscopies	NA	Retropharyngeal	No cultures reported	Antibiotics and drainage	Perforation	Uneventful recovery
9. Coulthard, Isaacs (1991)	Male	5 days	None	Regürtitation of e feeds through nose, cyanosis, submandibular swelling, respiratory distress	Retropharyngeal abscess	*Escherichia coli* (from aspirate)	Antibiotics and drainage	–	Uneventful recovery
10. Coulthard, Isaacs (1991)	Male	21 days	None	Neck swelling with crepitus, paraplegia	Retropharyngeal abscess	*Enterococcus faecalis* and coagulase-negative staphylococci (from aspirate)	Antibiotics and drainage	Paraplegia, fracture-dislocation of the atlas and axis, bacterial endocarditis, pneumonia	Death
11. Coulthard, Isaacs (1991)	Male	1 day	Third branchial arch pouch and sinus from the pyriform fossa to the left side of neck.	Respiratory distress, cyanosis, stridor, a high-pitched cry, sialorrhea, submandibular swelling	Posterolateral retropharyngeal abscess	Group B streptococcus, coagulase negative *Staphylococcus* and bacteroides species (from aspirate)	Antibiotics and drainage	Compression of the airway	Recurrence
12. Gudinchet (1991)	Female	10 days	None	Fever, hypotonia in the upper limb, sialorrhea,	Prevertebral and parapharyngeal abscess	*Staphylococcus aureus* (from aspirate)	Antibiotics and drainage	Upper limps paresis, vertebral osteomyelitis	Uneventful recovery
13. Jones (1993)	NA	22 days	Application of nasopharyngeal CPAP	Bradicardia, pharyngeal erythema and swelling	Retropharyngeal abscess	Cultures negative	Antibiotics	–	Uneventful recovery
14. Gaglani (1996)	Male	5 days	Endotracheal intubation, vigorous suctioning for meconium-stained fluid	Respiratory distress, poor feeding, fever, cyanosis, tachycardia, pharyngeal swelling, sialorrhea	Retropharyngeal abscess	*Escherichia coli*, *Bacteroides fragilis*, *Bacterioides bividus* (from aspirate)	Antibiotics and drainage	Pneumomediastinum, cervical lymphadenitis, bacteremia, meningitis, aspiration pneumonia	Mild hypertonia of the lower extremities
15. Abdullah (2002)	Female	13 days	None	Stridor, respiratory distress, tachycardia	Retropharyngeal abscess	Group B streptococcus (from aspirate)	Antibiotics and drainage	Compression of the airway	Uneventful recovery
16. Tsai (2003)	Male	4 days	Branchial-cleft sinus	Stridor, respiratory distress, poor feeding, fever	Retropharyngeal abscess	*Escherichia coli*, *Staphylococcus aureus* (from aspirate)	Antibiotics and drainage	Compression of the airway	Uneventful recovery

Table 1 (*Continued*)

Author (published year)	Gender	Age at diagnosis	Predisposing factors	Clinical presentation	Localization of abscess	Isolated pathogens	Treatment	Complications	Outcome
17. Rao (2007)	Female	7 days	None	Cyanosis, stridor, neck swelling	Retro and parapharyngeal abscess	*Candida albicans* (from aspirate)	Antimycotics, antibiotics and drainage	Compression of the airway	Uneventful recovery
18. Chen (2008)	Female	2 days	None	Neck swelling, horse crying, stridor, respiratory distress	Left retropharyngeal abscess	*Escherichia coli*, *Streptococcus viridians*, *Staphylococcus epidermidis* (from aspirate)	Antibiotics and drainage	Mediastinitis	Uneventful recovery
19. Falup-Pecurariu (2009)	Male	21 days	None	Fever, irritability, refusal to feed, sialorrhea, neck swelling	Left latero-pharyngeal abscess	MRSA[a]	Antibiotics	–	Uneventful recovery
20. Gathwala (2010)	Male	28 days	None	Fever, neck swelling, lethargy, refusal to feed	Retropharyngeal abscess	–	Antibiotics	Airway compression, extension into the superior mediastinum	Uneventful recovery
21. Chen (2011)	Male	17 days	None	Stridor, fever, dysphagia, neck swelling	Retropharyngeal, parapharyngeal, superior mediastinal abscess	Cultures negative	Antibiotics and drainage	Extension into the superior mediastinum, compression of the airway	Uneventful recovery
22. Our case	Male	10 days	None	Fever, irritability, and poor feeding	Parapharyngeal abscess	MSSA	Antibiotics and drainage	–	Uneventful recovery

[a] MRSA, methicillin-resistant *Staphylococcus aureus*; NA, not available; CPAP, continuous positive airway pressure.

Deep neck space infections can progress to life-threatening complications. Perforation, paraplegia, upper limps paresis, vertebral osteomyelitis, pneumomediastinum, cervical lymphadenitis, bacteremia, meningitis, aspiration pneumonia, mediastinitis, extension into the superior mediastinum, and compression of the airway have been reported as a complication of neonatal deep neck abscess [4–7,9–13,15,16]. Death in a newborn associated with deep neck abscesses was reported by Coulthard and Isaac [6]. Any complication was not observed in our case.

Mediastinal infections originating from deep neck infection is one of the most serious complications. The retropharyngeal space (RPS) extends from the skull base to T4 vertebral level [17]. RPS is bordered anteriorly by visceral fascia and posteriorly by the prevertebral fascia. Alar fascia is very thin fascia which divides the RPS into anterior (proper space) and posterior compartment (danger space) [17]. Proper space extends from the skull base to T4 vertebral level, while the danger space extends from the skull base to the diaphragm [17]. Retropharyngeal space continues into the superior and posterior mediastinum [17]. Infections of the RPS may rapidly spread downward to the mediastinum through the loose anatomic structure of the retropharyngeal, parapharyngeal and pretracheal spaces with the help of gravity and negative intrathoracic pressure [17,18].

Group B streptococcus, *S. aureus* and *Escherichia coli* are the most commonly isolated microorganisms from blood or aspirate in cases with neonatal deep neck abscesses [1–3,5–7,10,14]. Rao et al. [12] have been reported a newborn without obvious risk factors for retro and parapharyngeal abscess, which growth of *Candida albicans*. It may be caused by polymicrobial and the most frequently isolated organisms are *E. coli*, *Streptococcus viridians*, *Staphylococcus epidermidis*, *S. aureus*, *Enterococcus faecalis* and Gamma streptococcus [4,6,9,11,13]. In our case, the MSSA was grown in purulent material.

Some reports associated with pediatric deep neck infection were reviewed for to compare whether there are differences between deep neck abscesses in neonates and children. Therefore, demographic features, risk factors, clinical presentation, localization of abscess, causing microorganisms, and complications of deep neck abscesses in childhood were noted and it is shown in Table 2. Deep neck abscess has been more reported in male in both neonatal period and childhood [1,3,4,6,7,9–16,19–22,24,25]. Congenital malformations and resuscitation applications such as endotracheal intubation, suctioning are more frequent in neonatal patients with deep neck abscess [1,2,7,8,11,14,16], while upper respiratory tract infection, tonsillitis, sinusitis, odontogenic infection, cervical adenitis, otitis media are more common in children [19,21]. Respiratory distress and stridor are more commonly seen in neonatal period than children [1–4,6,9–13,16]. The most commonly isolated organisms in children with deep neck infections are MRSA, MSSA and *Streptococcus pyogenes* [19–25], while *Group B streptococcus*, *S. aureus* and *E. coli* are the most commonly isolated microorganisms from blood or aspirate in cases with neonatal deep neck abscesses [1–3,5–7,10,14]. Complications of deep neck abscesses in neonatal period are more common and serious than childhood [6–8,10–12,14–18,20,20,21,21,22,24,25]. Baldassari et al. [22] reported that mediastinitis is the most common complication in pediatric patient with deep neck abscesses. Complications are more common in pediatric deep neck abscesses especially caused by *S. aureus*, younger age at presentation and retropharyngeal location in childhood [22]. The outcome in children with deep neck infections is good, and without mortality, while mortality may be seen in neonatal period [6].

The definitive treatment is surgical drainage of the abscess and appropriate intravenous antibiotics. In our case, drainage and intravenous antibiotics were applied. An early clinical suspicion, diagnosis and appropriate management of infection may prevent

Table 2
Deep neck infection in childhood.

Author (published year)	*n*	Gender M/F (%)	Age at diagnosis	Predisposing factors or comorbid disease	Clinical presentation	Localization of abscess	The most commonly isolated organism	Complications
Meyer (2009)	179	60/40	MA: 50.2 (4.6–205.3) months	Otitis media (13%), *Streptococcal pharyngitis* (11.3%), sinusitis (7.3%)	Neck pain (48.0%), neck stiffness (42.9%), sore throat or odynophagia (35.0%), neck swelling (28.2%), and decreased oral intake (24.3%).	Retropharyngeal (49.7%), parapharyngeal (38.5%), others (11.8%)	Streptococci and anaerobes	Required repeat incision and drainage ($n=2$)
Shah (2009)	4	66/34 One of them unknown	8, 8, 9, and 18 months, respectively	NA	Fever (75%), neck swelling (75%), decreased neck mobility (25%)	Retropharyngeal (75%), parapharyngeal (25%)	MRSA (50%), MSSA (50%)	Mediastinitis ($n=4$), empyema ($n=1$)
Chang (2010)	21 (<10 years)	66/34	4.2 ± 3.1 years	Upper respiratory tract infection, tonsillitis, sinusitis, odontogenic infection, cervical adenitis	Fever (72%), odynophagia (52%), neck pain/mass (50%), uvular deviation (14%), trismus (12%)	Peritonsillar (58.6%), parapharyngeal (31%), mixed type (10.3%)	Mixed flora (22%), *Streptococcus pyogenes* (16%), other Streptococcus (13%), anaerobic bacteria (6%), *Staphylococcus aureus* (3%), *Klebsiella pneumonia* (3%), *Bartonella henselae* (3%)	Recurrence ($n=6$), bronchogenic cysts complicated by parapharyngeal abscess ($n=3$), mediastinitis ($n=2$), emphysema ($n=1$), airway compression ($n=1$)
	29 (10–18 years)	52/48	15.7 ± 2.6 years			Retropharyngeal (42.8%), parapharyngeal (38.1%), peritonsillar (19%)		
Baldassari (2011)	45	42/58	NA	NA	NA	Peritonsillar (62%), retropharyngeal (22%), parapharyngeal (16%)	*Streptococcus pyogenes*, *S. aureus*, mixed anaerobic bacteria, *Streptococcus viridans*, *Streptococcus intermedius*, and *Haemophilus influenzae*	Mediastinitis ($n=9$), required intubation for respiratory distress ($n=8$), persistent disease requiring repeat drainage ($n=1$), and jugular vein thrombosis ($n=1$)
	93	58/42	NA	NA	NA	Peritonsillar (46%), retropharyngeal (30%), parapharyngeal (24%)		
Duggal (2011)	136	44/56	MA:16 months (1 month–13 years)	SA infections more common in younger children (<16 months)	Fever, neck mass	The anterior triangle (37%), retropharyngeal (16%), posterior triangle (14%), parapharyngeal (12%), submandibular (12%), other (9%)	MRSA (42%), MSSA (30%), *Streptococcus pyogenes* (11%)	NA
Bolton (2013)	130	64/36	MA: 49 (26–84) months	NA	Fever (84%), neck mass (56%), decreased oral intake (56%), neck pain (53%), sore throat (43%), limited range of motion (39%), neck tenderness (37%), trismus (7%)	Retropharyngeal (54%), parapharyngeal (37%), in both deep neck spaces (9%)	Oral anaerobes (30%), normal upper respiratory flora (23%), *Streptococcus pyogenes* (19%), MRSA (12%), MSSA (4%), other (19%)	Required intubation for respiratory distress ($n=6$), persistence of symptoms ($n=4$), mediastinal extension/pleural empyema, pericarditis and septic shock ($n=1$), septic shock ($n=1$)
Cheng (2013)	178	65/35	MA: 34.5 (2–142) months	NA	Fever, ongoing pain, trismus, neck stiffness	Retropharyngeal (56.7%), parapharyngeal (31.7%), and mixed type (11.7%)	MRSA, *Streptococcus pyogenes*, and MSSA	Second drainage procedure required ($n=5$), readmission for IV antibiotic therapy ($n=3$), sepsis with cerebrovascular accident ($n=1$), sepsis, postoperative complications ($n=1$), internal jugular vein thrombus ($n=1$)

M/F, male/female; MA, median age; NA, not available; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-sensitive *Staphylococcus aureus*.

the life-threatening complications of deep neck abscess in the neonatal period.

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