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MAIN ARTICLE

Orbital infections: five-year case series, literature review and guideline development

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Abstract

Background: Periorbital infections represent a spectrum of sepsis that carries potentially significant morbidity and mortality. Early recognition, systematic assessment and aggressive treatment of the condition are essential.

Methods: A retrospective five-year case note review on the management of periorbital infections was performed at a tertiary centre. A literature review on the management of periorbital infections was also undertaken. A multidisciplinary guideline on the management of periorbital infections was developed based on the findings of the case and literature reviews.

Results: The results of the retrospective case series correlate well with those of recent reports.

Conclusion: The new multidisciplinary guideline has been finalised and approved for practice and future auditing.

Key words: Orbital Cellulitis; Paranasal Sinus Diseases; Sinusitis; Practice Guideline

Introduction

Orbital or periorbital sepsis affects the orbital contents and/or the soft tissues anterior to the orbit. Published reports contain clear variations in the terminology used to describe this spectrum of sepsis.[1–3] The incidence of this condition varies widely[1]; for example, one review showed an incidence range of 0.3–1.31 cases per month at specialist tertiary centres.[4] However, studies agree that orbital and periorbital infections more commonly occur as complications in the paediatric population.[5–7] The complications rates of the condition are also higher in children.[6,7]

The orbital septum (palpebral ligament) represents an essential landmark for classifying orbital and periorbital infections: it is a fascia extension between the orbital rim periosteum and the tarsal plate of the eyelid.[8–10] The infection, hence, is classified as preseptal (periorbital) or postseptal (orbital) according to its location relative to the orbital septum.[3,9,10] Abscess formation can be also classified as subperiosteal or intraorbital. Chandler *et al*. published the most commonly used system of classification of orbital and periorbital infections based on disease extent and severity (Table I).[1,8,11,12]

The most common primary source of infection (60–90 per cent) is the paranasal sinuses,[1,13] mainly the ethmoid and maxillary sinuses.[1,13–16] Other sources include infections of the adjacent orbital, cranial and facial structures.[13,16] The infection spreads mainly via the thinned lamina papyracea, localised dissemination of cellulitis and the communicating blood vessels.[1]

The microbiology of orbital cellulitis seems to be changing. *Haemophilus influenzae* used to be a leading causative organism in orbital sepsis, but has been seen less frequently since the introduction of *H. influenzae* type B vaccination. The most frequently isolated microbes are now various streptococcus and staphylococcus species.[8,14,17,18]

The condition can result in potentially serious complications such as endophthalmitis, blindness, cavernous sinus thrombosis, intracranial spread and, ultimately, death.[1,11,16,19] Diagnostic and therapeutic advances have led to a decline in morbidity and mortality, although both are still being reported.[20] Hence, a timely systematic assessment of the disease extent (preseptal and orbital cellulitis *vs* abscess formation), and prompt treatment are extremely important.[8,19] Reports suggest that treatment delay can result in blindness in up to 10 per cent of affected patients.[19]

Treatment of orbital or periorbital sepsis requires collaboration among various disciplines. However,

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TABLE I
CHANDLER'S CLASSIFICATION OF ORBITAL COMPLICATIONS OF SINUSITIS

Chandler's stage	Clinical stage
I	Preseptal cellulitis
II	Orbital cellulitis
III	Subperiosteal abscess
IV	Orbital abscess
V	Cavernous sinus thrombosis

there is clear ambiguity in the literature about who should manage this condition and how.[1,5,13,21] To address this, a variety of protocols for managing periorbital or orbital sepsis have been published.[22] In 2004, Howe and Jones presented a guideline on the management of orbital or periorbital infection which is widely used in the UK.[3,15,23]

Evaluating children with acute periorbital swelling can be difficult. Clinical findings alone may not be specific enough to distinguish preseptal cellulitis from postseptal uncomplicated cellulitis or complicated postseptal sepsis.[19] Computed tomography (CT) remains the investigation of choice to confirm the presence of an orbital pus collection, evaluate localised extensions and reveal concomitant sinus disease.[3,8,10,19] Therefore, a low threshold should be maintained for CT when an orbital pus collection is suspected or cannot be clearly assessed.[8,19]

This article describes a methodical evaluation of our practice regarding orbital or periorbital sepsis. A literature review is presented to compare patient outcomes with those of published results. Finally, the development of a new local guideline for managing orbital or periorbital infections based on the results of this study is described.

Materials and methods

Case series

A retrospective review was performed of the records of patients admitted with a diagnosis of orbital or periorbital infections between January 2008 and December 2012 at our tertiary centre. Patients were identified through the coding terms 'orbital infection', 'periorbital infection', 'orbital cellulitis', 'periorbital cellulitis', 'orbital abscess', 'periorbital abscess', 'orbital sepsis', 'periorbital sepsis' and 'subperiosteal abscess'. The resultant patient list was carefully assessed to exclude patients with coding errors. Patient notes were then retrieved, the relevant data were collected and a trend analysis was performed.

Literature review

A literature review was performed in January 2013 using a multistep search of Embase, Medline and Cochrane Library databases. Search terms included 'orbital', 'periorbital', 'peri-orbital', 'cellulitis', 'infection', 'sepsis', 'abscess' and 'subperiosteal'. The search was limited to articles published in English and only articles from the year 2006 onwards were included. This time restriction was imposed because the European guideline (*European Position Paper* ('EPOS')) for managing sinusitis and its complications was first published in 2005.[24]

The initial search identified 936 papers matching the criteria. The titles and abstracts were individually screened to identify relevant articles; case reports, editorials and letters were excluded. Full-length versions of 23 articles were subjected to a detailed assessment. Of these, 17 articles were included in the literature review. The search was repeated in June 2013, and no new articles were identified.

Guideline development

Based on the literature review and study findings, a draft guideline on the management of orbital or periorbital infections was prepared in April 2013. This was disseminated for review by specialists from the Departments of Microbiology, Ophthalmology, Otolaryngology, Paediatrics and Radiology at our tertiary centre. Subsequent drafts based on multidisciplinary feedback were presented at meetings of the Otolaryngology and Paediatric Departments. The final version was again distributed to the various specialists for final review and approval.

Results

During the study period, 54 patients were admitted to our tertiary hospital with a diagnosis of orbital or periorbital sepsis, representing an incidence of 0.9 patients per month or 10.8 patients per annum (Table II). Of these, 40 (74 per cent) were aged 16 years or less, and 14 (26 per cent) were adults. The mean (± SD) age was 5.8 ± 4.5 years (median 4.0 years) in the paediatric group and 51 ± 21.4 years (median 48.5 years) in the adult group. A total of 38 patients (70.4 per cent) scored a Chandler's stage of I or II (preseptal or orbital cellulitis without a pus collection). Of the remaining 16 patients (30 per cent) with abscess formation, 11 (20.4 per cent) had subperiosteal abscesses and 5 (9.2 per cent) had orbital pus collections. The infection affected the left side of the face in 33 patients (61 per cent), the right side in 19 (35 per cent) and was bilateral in 2 (4 per cent).

Most patients (34 (63 per cent)) were referred directly from primary care services to specialist services. Other sources of referral included the Emergency Department (12 patients (22 per cent)), the Ophthalmology Department (6 patients (11 per cent)) and other hospital departments (2 patients (4 per cent)). Nine patients (17 per cent) had been treated with oral antibiotics prior to referral, and the remaining 45 patients (83 per cent) were referred directly to secondary services.

A full multidisciplinary team (MDT) review (ENT + ophthalmology ± paediatrics) had taken place within 24 hours of admission for 28 patients (52 per cent). Of the remaining 26 patients (48 per cent), an MDT

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TABLE II
COMPARISON OF FIVE-YEAR STUDY AND LITERATURE REVIEW FINDINGS

Measure	Five-year case series	Literature review
Incidence of admissions	54 patients (0.9 patients/month)	0.3–2.0 patients/month (mean 1.1)
Paediatric : adult patients (%)	74:26	N/A
Paediatric age (mean ± SD)	5.8 ± 4.5 years	5.4 years
Adult age (mean ± SD)	51 ± 21.4 years	NA
Male : female ratio	N/A	167:100 (1 study, 82:100)
Chandler's stage (%)	I–II = 70.4 III = 20.4 IV = 9.2	III–V: range 1.0–83.0 (mean 29.0)
Affected side, L:R:Bil (%)	61:35:4	54:44:2
Referral source: primary care, other (%)	63, 37	N/A
Oral treatment prior to referral (%)	17	N/A
MDT review on 1st day (%)	52	N/A
High risk on admission (%)	28	N/A
CT on admission (%)	37	N/A
CT during admission (%)	50	12–92 (mean 48)
High-risk patients without CT (% of high-risk patients)	13	N/A
Low-risk patients with CT (% of low-risk patients)	18	NA
Cultures obtained (%)	48	NA
Isolated microbes (%)	Streptococcus, 31; staphylococcus, 31; anaerobes, 8	Commonest microbes: staphylococcus, streptococcus Other microbes: MRSA, anaerobes
IV antibiotics on admission (%)	94	NA
Antibiotics used (%)	IV co-amoxiclav 46 Oral co-amoxiclav 20 Other 33	Commonest, co-amoxiclav, cephalosporins*
Nasal decongestants (%)	48	59
Nasal steroids (%)	37	45
Surgical drainage (%)	28	NA
Revision surgery (% of the surgically drained)	13	NA
Duration of admission (days)	3.9 ± 3.5	4.24
Out-patient follow up (%)	43	NA
Duration of admission (days)	3.9 ± 3.5	4.24
Mortality (*n* (%))	1 (1.8)†	1 (N/A)‡

*2nd or 3rd generation. †Not related to infection. ‡From two studies. MDT = multidisciplinary team; CT = computed tomography; MRSA = methicillin-resistant *Staphylococcus aureus*; IV = intravenous; N/A = not applicable

review was either delayed until after the first 24 hours or did not take place.

At admission, 15 (27.7 per cent) patients had documented high-risk symptoms and signs. Twenty (37 per cent) patients underwent CT scanning on the admission day and a total of 27 patients (50 per cent) underwent CT scanning during the entire admission period. Two patients (13 per cent) with high-risk features at admission did not undergo imaging, and seven patients (18 per cent) with no high-risk features at admission underwent CT scanning.

A discussion with the on-call microbiologist took place for 4 patients (7 per cent) on the admission day and in 16 (30 per cent) throughout the admission period. Samples for bacterial culture and sensitivity analysis were obtained from 26 patients (48 per cent); of these, 14 samples (54 per cent) gave negative findings. Of the 12 positive samples (46 per cent), streptococcus species grew in 8 (31 per cent), staphylococcus species in 8 (31 per cent) and anaerobes in 2 (8 per cent).

Most patients (51 = 94 per cent) were promptly treated with intravenous antibiotics upon admission. As suggested by the existing local antibiotics guideline, the most commonly used antibiotic was co-amoxiclav (total, 36 (67 per cent); oral administration only, 11 (20 per cent); intravenous administration only, 25 (46 per cent)). Five patients (9.3 per cent) were initially treated with co-amoxiclav, and then changed to treatment with another intravenous antibiotic. Thirteen patients (24 per cent) were treated with various combinations of other intravenous antibiotics.

Systemic steroids were not used; however, 20 patients (37 per cent) received topical nasal steroids and 26 (48 per cent) received topical nasal decongestants.

A total of 15 patients (28 per cent) had undergone a surgical procedure during admission; two of these (13 per cent) needed revision surgery during admissions. Four of the 15 patients (27 per cent) with documented high-risk features on admission did not require a surgical procedure.

The mean duration of admission was of 3.9 ± 3.5 days (median 4 days). Follow-up out-patient appointments were given to 23 patients (43 per cent); 20 (37 per cent) of those were with ENT services. One elderly patient (1.85 per cent) with multiple co-morbidities died as a result of a cardiac event and multiple systems failure.

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Comparison of literature review and case note review outcomes

A total of 17 articles were included in the review: all were retrospective notes reviews. Sixty-five per cent of studies were carried out in a tertiary centre, one (6 per cent) was an American national study, one (6 per cent) had combined data from a tertiary centre and a district general hospital (DGH), and the remaining 4 studies (23 per cent) were carried out in DGHs. The study periods ranged from 1 to 14 years, with a mean of 6 years.

Of these, 15 studies could be used to assess the incidence of periorbital or orbital sepsis: 11 studies showed the incidence per hospitalised patient, while 4 studies showed the incidence as per Emergency Department attendance. The incidence of admission with orbital or periorbital infections varied from 0.3 to 2.0 per month (mean 1.1 per month). When attendances to Emergency Departments were taken into account, the incidence numbers increased to 5.5–8.9 attendances monthly (mean 6.8 attendances monthly). Our study shows an incidence of hospitalisation of 0.9 patients per month.

The results of the literature review cannot be used to predict age characteristics because most studies assessed paediatric patients. In the paediatric population, the mean age in the literature review was 5.35 years. In our study, the mean age was 5.8 years. Interestingly, the literature review showed that the condition may be more common in male patients; the overall male-to-female ratio was 167:100, except for one study that showed a slightly greater prevalence of females (male-to-female ratio 82:100). Our study did not assess patient demographics except for age.

In the literature review, laterality of the infected site was documented in five studies: left side, 54 per cent, right side, 44 per cent; and bilateral disease, 2 per cent. A similar tendency was demonstrated in our cohort, with the left side being affected in 61 per cent of patients, the right side in 35 per cent and bilateral infection in 4 per cent.

Discussion

Both the literature review and local data review showed the commonest causative microbes to be staphylococcus and streptococcus species. Other microbes included methicillin-resistant *Staphylococcus aureus*, anaerobes and other mixed organisms. Positive findings for bacterial growth varied widely in the literature, but most studies agreed that the most useful specimens were taken during surgical drainage. Abscess formation also varied widely in the literature, from 1 per cent to 83 per cent (mean 29 per cent); it occurred in 30 per cent of patients in our study group. The use of CT imaging also varied widely in the literature review, from 12 per cent to 92 per cent of patients (mean 48 per cent). Fifty per cent of our patients underwent CT imaging.

The most commonly used antibiotics in the literature review were co-amoxiclav and/or cephalosporins (second or third generation), either alone or combined or with other antibiotics. Other antibiotics used included benzyl penicillin, clindamycin, flucloxacillin, metronidazole and vancomycin. Co-amoxiclav was also the most commonly used antibiotic in our five-year study. The use of topical nasal decongestants was assessed: the mean compliance was 59 per cent in four studies in the literature review and 48 per cent in our study. Topical nasal steroids were also used: the mean compliance was 45 per cent in two studies in the literature review and 37 per cent in our study.

In 10 studies, the mean duration of hospitalisation was 4.24 days. This was clearly longer in patients with post-septal infections and in surgically treated patients. In our study, the mean duration of admission was of 3.9 ± 3.5 days. One death was reported in each of two reported studies; one death was documented in our patient group.

- **Various disciplines are involved in managing orbital infections**
- **However, there is uncertainty as to who should be managing this condition and how**
- **There are obvious variations in managing this condition, both locally and in the literature**
- **The multidisciplinary guideline standardises orbital infection management**
- **The guideline is not intended to standardise surgical techniques**

Several key messages can be taken from our study data. There have been clear variations in practice regarding who performs and reviews the assessment of patients with orbital or periorbital infections, and how this is done. Half of our patients had no samples taken for microbiological analysis. There have been clear variations in practice regarding the use of topical nasal preparations (steroids and decongestants). Some high-risk patients did not undergo CT imaging and some non high risk patients did. Half of our patients had not received out-patient follow up after discharge.

The new guideline

Based on the literature review and study findings, a multidisciplinary guideline for managing orbital or periorbital infections was drafted in April 2013. It was designed to include a care pathway flowchart fitting an A4 single sided sheet and an appendix of a similar size (Figures 1&2). The multidisciplinary guideline was finalised in September 2013 and submitted to the trust's medical directors. It received final approval and was thereafter integrated into our regional policies.

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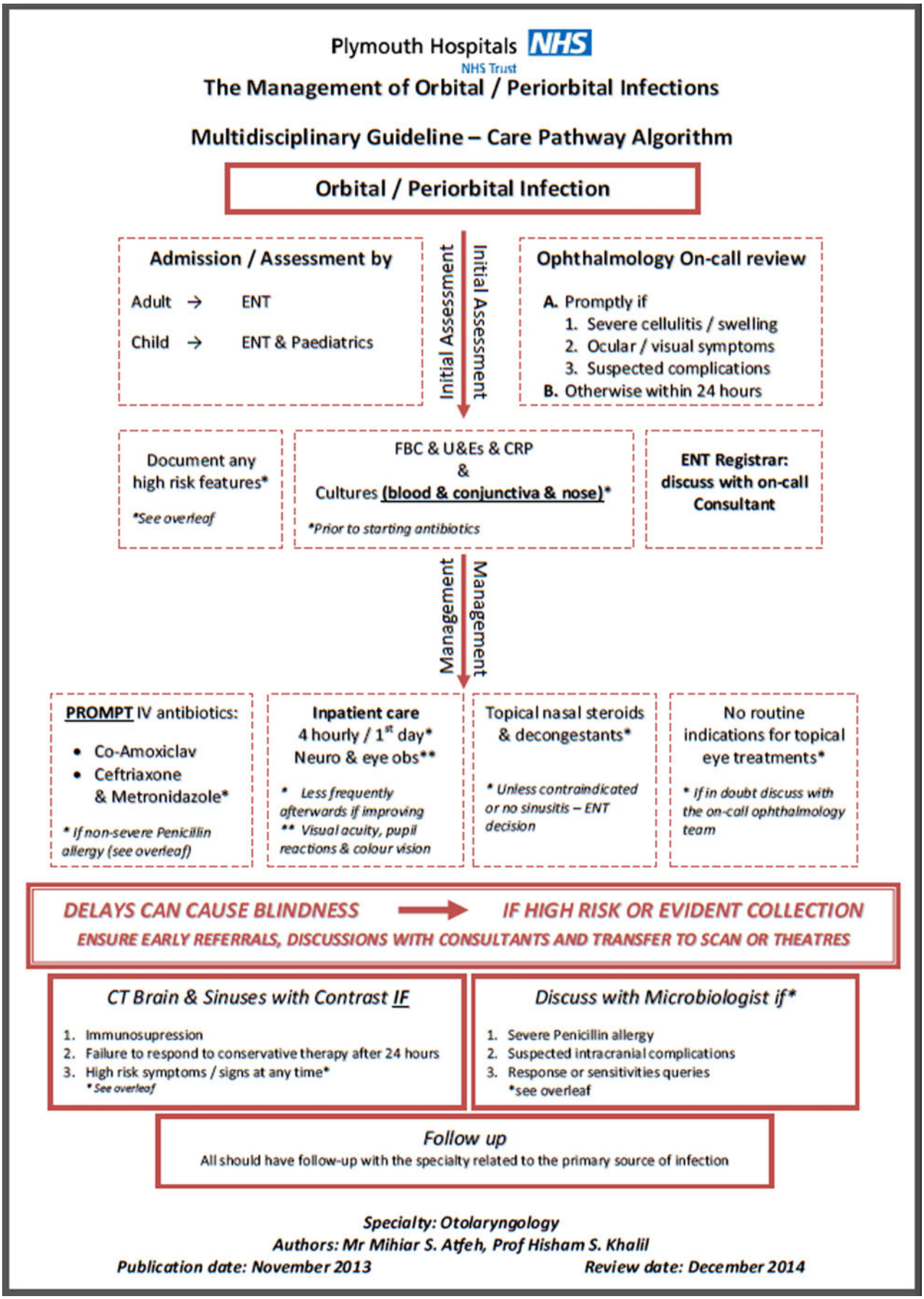

FIG. 1
Clinical guideline.

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The Management of Orbital / Peri-orbital Infections

Multidisciplinary Guideline – Appendix

Chandler et al.: Peri-orbital infections classification

1. Preseptal cellulitis
2. Orbital cellulitis
3. Subperiosteal abscess
4. Orbital abscess
5. Cavernous sinus thrombosis / Intracranial complications

High risk features

1. Blurring / reduced visual acuity
2. Disturbed colour vision
3. Ophthalmoplegia (restricted eye movements, double vision)
4. Proptosis
5. Severe swelling preventing accurate assessment of the globe
6. Pupillary dysfunction (relative afferent pupil defect)
7. Any sclera changes
8. Any neurological signs
9. Bilateral periorbital oedema

Antibiotics notes: *If in doubt refer to Trust policy / discuss with on call Microbiologist*

- Penicillin allergy
    1. Type 1 anaphylaxis / urticaria / Stephens-Johnson's: **Avoid all Beta Lactams** (penicillins / Cephalosporins / Carbapenems / Aztreonam)
    2. Non-urticarial rash to Penicillins:
       Can receive a Cephalosporin in a controlled environment
- Ceftriaxone is a restricted access antibiotic

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FIG. 2
Guideline appendix.

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