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Review

Systematic review of the role of corticosteroids in cervicofacial infections

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Abstract

The role of corticosteroids in the management of cervicofacial infections continues to cause controversy. Systemic anti-inflammatory and immunomodulatory effects that reduce swelling and improve symptoms in the head and neck may make these agents an effective addition to the antibiotics used and to surgical management, although this same effect may dull the physiological response to infection, and allow infections to progress. We have systematically reviewed the evidence for the use of corticosteroids in common cervicofacial infections following the PRISMA guidelines. MeSH terms included "head", "neck", "infection", and "glucocorticoid". In total, 31 papers were identified. Eight reported the use of corticosteroids for peritonsillar abscess (PTA), 10 for pharyngitis, four for deep neck space infection (DNSI), four for periorbital cellulitis, and five for supraglottitis. Whilst there is an established evidence base for their use in the treatment of PTA and pharyngitis, other indications need further study, and we highlight the potential pitfalls. The evidence suggests that the use of adjunctive, short-term, high-dose corticosteroids in cervicofacial infections may be safe and effective.

Keywords: MeSH terms: Head; Neck; Glucocorticoid; Infection; Surgery

Introduction

The role of corticosteroids in the management of deep cervicofacial infections continues to cause controversy.[1] Such infections are responsible for severe morbidity and death, and are a common emergency presentation to maxillofacial and otorhinolaryngology departments in the UK.[2] Mortality has historically been high, but advances in surgical management, antibiotic treatment, and imaging, have reduced it to around 2.4% in the case of deep neck space infections (DNSI).[3] Optimal management has been refined as new evidence emerges, and the role of corticosteroids continues to evolve. Timely systematic review of the current evidence is therefore important.

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Cervicofacial infections present in many different ways depending on the fascial space(s) involved. The most common portals of bacterial entry are the pharyngeal tonsils, teeth, salivary glands, necrotic lymph nodes in the region, and as a result of trauma to the oesophagus and oropharynx.[4,5] Whilst the source of infection, type of bacteria, and exact spaces involved vary, presentation and management are broadly similar, as are the principles of management. A review of the use of corticosteroids in the management of all cervicofacial infections is therefore relevant.

Treatment is usually medical and surgical, with or without the use of adjunctive corticosteroids, although the specifics vary among departments.[6,7] Current medical management aims to reduce both septic load and compromise to the normal functions of the head and neck. The principles of the International Consensus for the Management of Sepsis[8] are followed, with oxygen, fluids intravenously, broad spectrum antibiotics and, where possible, removal of the source of infection with incision and drainage or aspiration. When used as an adjunct to this, it has been suggested that corticosteroids can reduce airway oedema, nausea and vomiting, and trismus, and improve pain and the swallowing of fluids.[9,10]

Whilst these drugs have a number of advantageous effects, they also have the potential to worsen infection, confuse the clinical picture, and dull the immune response.[11,12] Chronic dosage may induce mood changes, hyperglycaemia, immunosuppression, avascular necrosis, nausea, and abdominal pain,[13] and in diabetic or immunocompromised patients, the effects may cause unacceptable complications.

Given their potential benefits and costs in the treatment of cervicofacial infections, a rigorous investigation of the evidence for and against their use is important, and we have therefore systematically reviewed their role.

Method

Focused question

We developed the following focused question according to the population, intervention, comparison and outcome (PICO) study design: What is the current role of corticosteroids in the management of patients with cervicofacial infections?

Information sources and search

We searched MEDLINE, Pubmed, Embase, and Google Scholar using the MeSH terms “infection”, “head and neck”, and “glucocorticoid” in various combinations. Other search terms included “steroid”, “cellulitis”, “facial”, “pharyngitis”, “deep neck space infection”, “orbital”, “periorbital”, and “abscess”. The primary search strategy was “infection” AND (“head” OR “neck”) AND “glucocorticoid”. We also hand searched the references of each of the studies.

Selection of studies

Studies were limited to those on humans, and both primary authors (SK and AH) screened the papers by title and abstract. One paper that was written in Persian was translated into English before being reviewed.[14]

*Types of **publication***

The review included case series that reported more than five patients, cohort studies, and controlled trials. Letters, editorials, case reports, small case series (n = fewer than five), review articles, systematic reviews, and meta-analyses, were excluded, as were papers that dealt only with tonsillitis, superficial oral mucosal conditions, and superficial skin conditions. Infections in the head but not the face or neck (such as cerebral abscess) were also excluded.

Types of participants/population

The studies identified all patients who had had a cervicofacial infection, and whose treatment included glucocorticoids.

Data extraction and data items

The data extracted included the year of publication, number of participants, area being studied (peritonsillar abscess (PTA), DNSI, periorbital cellulitis and abscess, pharyngitis, and epiglottitis and supraglottitis), the type and dose of corticosteroid, and its effect (positive, negative, or equivocal), and side effects. Data were extracted independently by two of the authors. Both reviewed the studies on pharyngitis and agreed about which data to extract.

Risk of bias

Studies were assessed according to type: the Newcastle Ottowa grading system[15] was used for cohort and case studies, and the Cochrane collaboration tool for randomised controlled trials.[16]

Synthesis of results

A narrative analysis was done of each separate anatomical area. No further statistical analysis was possible given the heterogeneity of the results.

Results

A total of 31 papers described the use of corticosteroids for the treatment of infections in the head and neck (Table 1). Papers were divided according to the infection treated: DNSI (n = 4), supraglottitis and epiglottitis (n = 5), periorbital cellulitis (n = 4), pharyngitis (n = 10), and PTA (n = 8). Fig. 1

Table 1
Characteristics of the studies on corticosteroids (CS).

First author, year, and reference	Type of corticosteroid and dose	Study design	Newcastle Ottowa score	Risk of bias (Cochrane Collaboration tool)	No.	Anatomical area	Reported effect of corticosteroid	Side effects
Page 2008[17]	IV methylprednisolone 1 mg/kg	Case series	–	–	16	Deep neck space infection	Positive - authors reported that a short course of CS is beneficial in relieving trismus and pain	No
Pelaz 2009[18]	IV methylprednisolone 1 mg/kg	Case series	–	–	7	Deep neck space infection	Positive - authors reported that odynophagia and torticollis improve rapidly with IV CS	No
Marioni 2006[19]	Not mentioned (“IV CS”)	Cohort study	9	–	103	Deep neck space infection	Positive - part of standard treatment protocol	No
Cho 2016[20]	Not specified	Cohort study	8	–	91	Deep neck space infection	No difference: 29% given CS	No
Glicklich 1979[21]	IV dexamethasone 0.4 mg/kg	Case series	–	–	40	Epiglottitis	Positive - authors impressed with rapidity of improvement in airway oedema	No
Ossof 1980[22]	IV dexamethasone 8 mg	Case series	–	–	15	Epiglottitis	No difference - all patients given CS	No
Stair 1985[23]	IV methylprednisolone, dexamethasone or hydrocortisone	Case series	–	–	20	Supraglottitis	No difference - 12 given IV CS, no difference in outcome	No
Qazi 2009[24]	IV dexamethasone or hydrocortisone	Cohort study	8	–	47	Epiglottitis	Positive - authors observed that CS reduced airway obstruction in about 19 patients	No
Riffat 2011[10]	IV dexamethasone or hydrocortisone	Cohort study	9	–	169	Supraglottitis	Positive - ITU stay was less than 24 hours in patients given CS	No
Davies 2015[25]	Oral prednisolone 1 mg/kg	Case-controlled	–	–	31	Periorbital cellulitis	Positive - CS group had shorter duration of stay	Two cases of CS-related hyperactivity
Chen 2018[26]	IV dexamethasone 0.3 mg/kg TDS	Case-controlled	9	–	43	Orbital cellulitis	Positive - shorter duration of stay in the group treated with CS	Hyperactvity and insomnia

Yen 2005[27]	Not specified	Cohort study	–	–	23	Orbital cellulitis	No difference - 12 given CS, no difference in duration of stay	No
Pushker 2013[28]	IV methylprednisolone	RCT	–	Low (no dropout mentioned, blinding of patient or assessor, intention to treat analysis, or power calculation)	21	Orbital cellulitis	Positive - faster resolution of pain, oedema, chemosis, and proptosis	No
O'Brien 1993[29]	IV dexamethasone 10 mg	RCT	–	Low	58	Pharyngitis	Positive - improved pain scores at 24 hours and shorter time to being pain free	No
Marvez-Valls 1998[30]	IM betamethasone	RCT	–	Low	92	Pharyngitis	Positive - lower pain score at follow up and less time to being pain free	No
Marvez-Valls 2002[31]	Oral prednisolone 60 mg or IM dexamethasone 10 mg	RCT	–	Low	78	Pharyngitis	No difference between the two groups	No
Wei 2002[32]	Oral dexamethasone 10 mg or IM dexamethasone 10 mg	RCT	–	Low	118	Pharyngitis	Positive - both CS groups showed improvements in pain and activity levels at 12 and 24 hours	No
Bulloch 2003[33]	Oral dexamethasone 0.3 mg/kg	RCT	–	Low	184	Pharyngitis	Positive - improved time to being pain free for patients who tested positive for group B haemolytic Streptococci	No
Roy 2004[34]	Oral dexamethasone 0.3 mg/kg	RCT	–	Low	40	Pharyngitis	Positive - CS group showed lower pain levels at 12 hours, though no difference at 24 hours	No
Olympia 2005[35]	IV dexamethasone 10 mg	RCT	–	Low (no power calculation)	150	Pharyngitis	Positive - improved pain at 24 hours, improved time to normal swallowing	No
Kiderman 2005 [36]	Oral prednisolone 60 mg	RCT	–	Low	79	Pharyngitis	Positive - reduced pain at 12 and 24 hours	No

Table 1 (*Continued*)

First author, year, and reference	Type of corticosteroid and dose	Study design	Newcastle Ottowa score	Risk of bias (Cochrane Collaboration tool)	No.	Anatomical area	Reported effect of corticosteroid	Side effects
Niland 2006[37]	Oral dexamethasone	RCT	–	Low (method of randomisation not reported)	84	Pharyngitis	Positive – Patients given CS showed greater improvement in general condition and faster return to normal activity	No
Tasar 2008[38]	IM dexamethasone 8 mg	RCT	–	Low (no power calculation)	73	Pharyngitis	Positive – onset of pain relief and mean time to complete resolution of pain shorter in CS group	No
Millar 2007[39]	Not mentioned (“corticosteroid”)	Cohort study	9	–	229	Peritonsillar abscess	No difference - 37% given CS, no differences in duration of stay or other outcomes	No
ENT Trainee Research Collaborative – West Midlands. 2016[7]	IV dexamethasone (one patient given prednisolone)	Cohort study	9	–	325	Peritonsillar abscess	No difference - 70% of patients given CS, no differences in outcome reported	No
Souza 2016[40]	Not specified	Cohort study	9	–	297	Peritonsillar abscess	No difference - 95% of surgically managed patients given CS	No
Ozbek 2004[41]	IV methylprednisolone 2–3 mg/kg (up to 250 mg)	RCT	–	Unclear (dropouts not described, no power calculation or primary outcome measure)	62	Peritonsillar abscess	Positive - improved time to normal swallowing, normal body temperature, and time to discharge	No
Shaikh 2008[42]	IV methylprednisolone 2–3 mg/kg	RCT	–	High (randomisation not described, no dropouts, blinding, power calculation, or primary outcome)	50	Peritonsillar abscess	Positive - improvements in trismus, time to normal temperature, and time to swallowing liquids	No
Mirvakili 2009[14]	IV dexamethasone 8 mg	RCT	–	Unclear (dropouts not mentioned, no power calculation)	50	Peritonsillar abscess	Positive - improved time to discharge and time to normal temperature	No
Chau 2014[43]	IV dexamethasone 10 mg	RCT	–	Low (no power calculation)	41	Peritonsillar abscess	Positive - improved pain at 24 hours	No
Koçak 2018[44]	IV methylprednisolone 1 mg/kg	Retrospective case controlled	8	–	32	Peritonsillar abscess	Positive - improvement in pain and mouth opening at 24 hours, which was lost by 7 days	No

IV = intravenous; IM = intramuscular; RCT = randomised controlled trial.

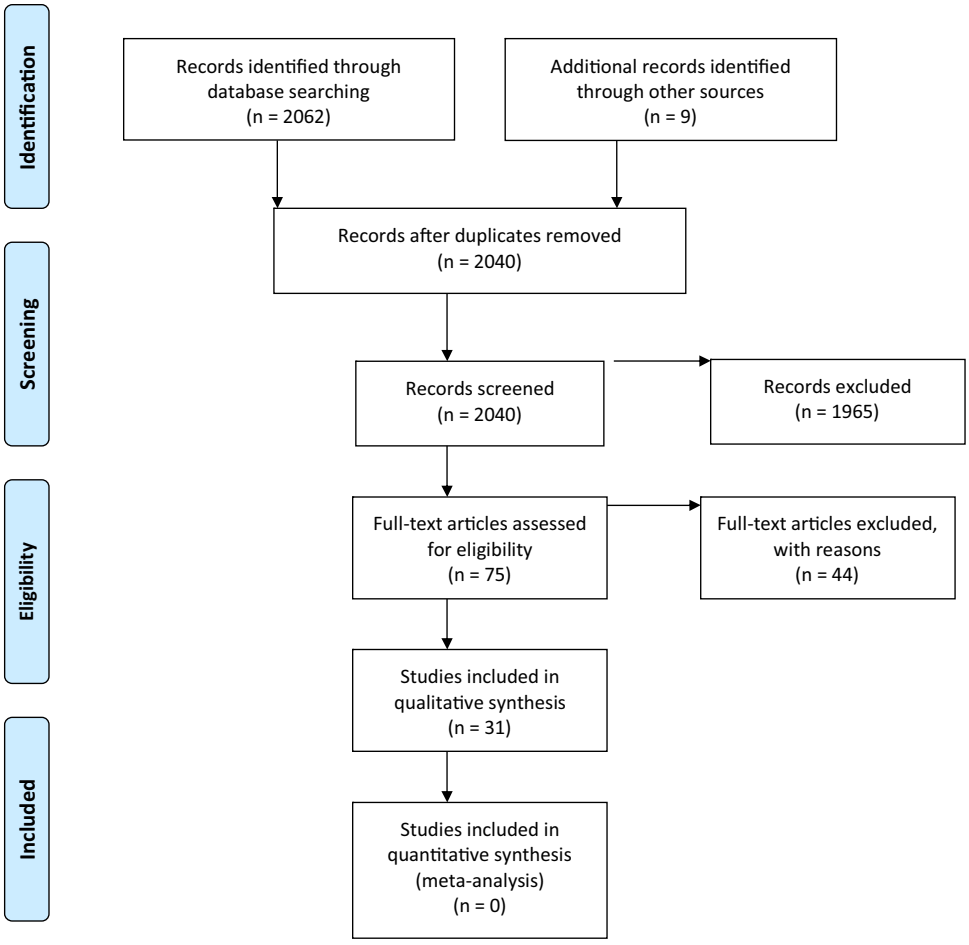

Fig. 1. PRISMA flow diagram.

Table 2
Assessments of risk of bias for randomised controlled trials (Cochrane collaboration tool).

First author, year, and reference	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Pushker 2013[28]	+	−	−	−	−	?	+
O'Brien 1993[29]	+	+	+	−	+	+	?
Marvez-Valls 1998[30]	+	+	+	+	?	+	+
Marvez-Valls 2002[31]	+	+	+	+	?	+	+
Wei 2002[32]	+	+	+	−	+	+	?
Bulloch 2003[33]	+	+	+	+	+	+	+
Roy 2004[34]	+	+	+	+	+	+	+
Olympia 2005[35]	+	+	+	+	+	+	?
Kiderman 2005 [36]	+	+	+	+	+	+	+
Niland 2006[37]	+	+	+	+	+	+	+
Tasar 2008[38]	+	+	+	+	+	+	+
Ozbek 2004[41]	−	+	+	−	−	?	?
Shaikh 2008[42]	−	−	−	−	−	?	−
Mirvakili 2009[14]	+	−	+	+	−	+	?
Chau 2014[43]	+	+	+	+	+	+	+

Low risk (+); high risk (−); unclear risk (?).

shows the PRISMA search strategy, and Table 2, the assessment of the risk of bias.

Deep neck space infection (DNSI)

Four studies related to the treatment of DNSI.

Page et al reported a case series of 16 patients with parapharyngeal abscess[17] who were treated non-surgically with antibiotics intravenously. Fifteen were also given methylprednisolone intravenously for between three and seven days. The authors reported that a brief course of intravenous corticosteroid treatment (five days) seemed "to be useful to rapidly relieve oral symptoms, especially pain and trismus". No adverse effects were noted.

Pelaz et al reported a case series of seven children with DNSI, who were all treated with corticosteroids and antibiotics intravenously, and no operation.[18] The mean duration of treatment was seven days, but the maximum duration was not noted. The symptoms resolved successfully in all cases, and there were no negative side effects relating to the corticosteroids used.

Marioni et al reported a case series of 103 patients with DNSI, 24 of whom were over 65 years of age.[19] All were treated with antibiotics and corticosteroids intravenously, and 75 also had operations. The duration of corticosteroid treatment was not noted. The primary finding was that mortality in the elderly patients with coexisting conditions was not appreciably worse than it was in those who were younger. No negative side effects from the use of corticosteroids were reported, but their type and dose were not recorded.

In their retrospective cohort study, Cho et al reported that DNSI was associated with PTA in 20% of 91 patients, and that 16% of the infections were odontogenic.[20] Twenty-five (27.9%) patients had corticosteroids as part of their treatment, but no difference in outcome was reported. The duration of corticosteroids was not noted, and no negative effects of their use were reported.

Supraglottitis and epiglottitis

Five papers reported the treatment of patients with supraglottitis and epiglottitis.

Glicklich et al described a case series of 40 patients with epiglottitis who were all treated with corticosteroids as part of their standard protocol.[21] They suggested that corticosteroids and antibiotics given intravenously, together with observation, are superior to intubation. They also noted that, with respect to the corticosteroids, they had been impressed by the rapidity at which the airway oedema improved, "usually within 1−3 hours, and with less tendency to deterioration".

Ossoff et al described 15 cases of acute epiglottitis in adults. Medical management of all the patients involved corticosteroids and antibiotics, both intravenously, for an unspecified duration.[22] There was no record of complications or adverse events. The authors concluded that provision of an adequate airway was the most important aspect of management, and that treatment with antibiotics, humidified oxygen, and corticosteroids were key to achieving this.

Stair and Hirsch reported the use corticosteroids (methylprednisolone, prednisolone, or hydrocortisone) intravenously for an unspecified duration in 12 of 20 adults with supraglottitis. There was no difference in outcome.[23]

Qazi et al retrospectively studied a group of 47 patients with epiglottitis who had all been given corticosteroids and antibiotics intravenously.[24] Despite no statistical analysis of the effect of the corticosteroids being possible, the authors observed that they "had an overall effect on the degree of airway obstruction, reducing it in about 19 patients". No adverse effects were reported.

In their retrospective cohort study of 169 patients with supraglottitis, Riffat et al reported that 89% of the patients were admitted to the intensive care unit (ICU) for observation or organ support.[10] They noted that patients with pre-existing diabetes mellitus were more likely to require tracheostomy. Corticosteroids were used in 140 patients for an unspecified duration, and their use was associated with a considerably shorter stay in the ICU.

Orbital cellulitis

Four papers described the use of corticosteroids in orbital and periorbital cellulitis.

In their case controlled trial, Davies et al described the treatment of 31 children with periorbital cellulitis. Seven were given antibiotics alone, and 24 antibiotics and corticosteroids, depending on whether the parents consented to treatment.[25] Fifteen patients also had sinus surgery with orbitotomy when required. Corticosteroids were given only when concentrations of C-reactive protein had returned to normal. There was a significant difference in duration of stay, which favoured the corticosteroid group. The authors also reported two cases of corticosteroid-related hyperactivity in children who had previously been diagnosed with attention hyperactivity disorder. Treatment was stopped after three doses in one child, but was not affected in the other.

Chen et al reported a prospective non-randomised controlled trial in which children with orbital abscesses were treated intravenously either with antibiotics, or antibiotics and corticosteroids, depending on parental preference.[26] The hospital stay in the corticosteroid group was significantly shorter (up to six days) than it was in the other group (up to nine days). The side effects of the corticosteroids, which included hyperactivity in three children and insomnia in one, did not require the treatment to be stopped.

Yen and Yen retrospectively studied 23 children with orbital cellulitis and subperiosteal abscesses, who required drainage and antibiotics intravenously.[27] Twelve were given additional corticosteroids intravenously for about six days, and 11 were not. There was no difference in duration of stay or outcome between the groups, but the corticosteroid group was less likely to be given additional antibiotics intravenously on discharge. No adverse effects were reported.

Pushker et al reported the results of a randomised controlled trial of 21 patients with orbital cellulitis.[28] Patients were treated intravenously with antibiotics alone, or with antibiotics and additional corticosteroids on days four to seven of their treatment. Those in the corticosteroid group showed faster resolution of pain, oedema, chemosis, and proptosis, on objective measures, and there were no negative side effects.

Pharyngitis

Ten of the studies related to the treatment of pharyngitis.

O'Brien et al conducted a double blind, randomised controlled trial that compared a single-dose corticosteroid with placebo in the management of pharyngitis in 58 adults.[29] Those treated with the corticosteroid had lower pain scores at 24 hours and were free from pain earlier than those in the control group. No adverse effects of the corticosteroid were reported.

In a double-blind, randomised controlled trial of the role of single-dose corticosteroids in the treatment of exudative pharyngitis, Marvez-Valls[30] reported that mean pain scores and the mean number of hours to complete relief of pain were significantly lower in the corticosteroid group. There were no significant differences in the number of days missed from school or work. The study, however, was limited by the absence of a report on the use of analgesics in the two groups.

Marvez-Valls et al also conducted a randomised controlled trial on patients with acute exudative pharyngitis.[31] Patients were given antibiotics with corticosteroids intramuscularly (n = 35), or antibiotics with corticosteroids orally (n = 35). There was no difference in pain relief between the groups.

Wei et al conducted a double-blind, randomised controlled trial on the efficacy of single-dose corticosteroids as adjuvant treatment for acute pharyngitis.[32] There were three treatment arms: corticosteroid 10 mg intramuscularly and oral placebo; corticosteroid 10 mg orally and placebo intramuscularly; and placebo orally and intramuscularly. All patients had antibiotics for 10 days. Pain was relieved a median of four hours earlier in those who were given corticosteroids than in those who were given placebo (intramuscularly 5.8 hours; orally 6 hours; placebo 10.1 hours), and the difference was significant. None who was given the corticosteroid intramuscularly returned to the unit for further care, but three who had taken it orally, and six who had had placebo, returned within five days.

In a double-blind, randomised controlled trial, Bulloch et al studied the efficacy of a single oral dose of a corticosteroid in children with pharyngitis who presented to the emergency department.[33] A total of 184 children were enrolled and 92 of them were given corticosteroids. Only those who tested positive for Group B haemolytic Streptococci showed a significant improvement in the time to being pain free (median 6 hours compared with 11.5 hours).

Roy et al conducted a double-blind randomised controlled trial on the efficacy of a single dose of corticosteroid to treat children with exudative pharyngitis. All of them were given antibiotics;[34] 20 were also given a single dose of a corticosteroid, and 20 a placebo. The corticosteroid reduced pain at 12 hours, but there was no significant difference in the overall time to pain relief between the groups.

Olympia et al reported the results of a double-blind, randomised controlled study on the efficacy of a single intravenous dose of a corticosteroid in the treatment of pharyngitis in children.[35] Sixty-eight patients were given antibiotics alone, and 57 antibiotics and corticosteroids. There were significant differences in pain at 24 hours, time to swallowing liquids, and time to being pain free, all of which favoured the corticosteroid group.

In a double-blind, randomised controlled trial in general practice, Kiderman et al[36] randomly assigned 79 patients with pharyngitis to treatment with corticosteroids or placebo. Pain scores were lower in the corticosteroid group at 12-hour and 24-hour follow up, but by 36 hours, the difference was not significant. There were no significant differences between the groups in the amount of time taken off work or study.

In a double-blind, randomised, trial with three arms, Niland et al compared three daily oral doses of corticosteroid with a single dose of corticosteroid and placebo in patients (aged between 4 to 21 years) with confirmed Group A beta-haemolytic streptococcal pharyngitis.[37] The results from 84 patients showed significant improvements in general condition and return to normal activity in those who had had the corticosteroid (three doses or one) when compared with the controls. There was no significant difference between the two corticosteroid arms in the resolution of a sore throat, and no difference between all three study arms with respect to the number of days missed from work or school.

Tasar et al conducted a double-blind, randomised controlled trial of 73 patients who were admitted with exudative pharyngitis.[38] They were randomised into corticosteroid or placebo control groups. The mean times to the onset of pain relief and to complete resolution of pain were significantly shorter in the treatment group, and there were no complications or complaints from the patients.

Peritonsillar abscess

Eight studies related to the treatment of peritonsillar abscess (PTA).

In their retrospective cohort study, Millar et al described the treatment of 229 children (under 18 years of age) with PTA at a single centre.[39] Thirty-seven per cent of the children were given corticosteroids intravenously. Other treatments included aspiration and antibiotics intravenously. There was no difference in outcome, and differences in duration of stay between those who did and did not have corticosteroids were not significant.

The main area of interest in the retrospective cohort study of 297 patients with PTA by Souza et al[40] was the difference in outcome between those managed surgically (n = 199) and those managed medically (n = 98). In the medically-treated

group, 78% were given corticosteroids intravenously as well as antibiotics, whilst in the surgically-managed group, 95% were given corticosteroids. There was no difference in outcome between the groups.

The ENT trainees Research Collaborative of the West Midlands reported a retrospective cohort study of 352 patients who were treated at 42 centres in the West Midlands, UK.[7] A total of 229 (70%) were treated with corticosteroids intravenously as part of their treatment, and they caused no adverse effects. There was no difference in outcome between those treated with and without corticosteroids.

Ozbek et al conducted a randomised controlled trial of 62 patients with PTA.[41] The first treatment group had aspiration, and antibiotics and a single dose of corticosteroids intravenously, whilst the second group had aspiration, antibiotics intravenously, and no corticosteroids. There were significant differences in the times to normal swallowing, normal body temperature, and discharge (three compared with four days), all of which favoured the corticosteroid group.

In a randomised controlled trial of 50 patients with PTA by Shaikh,[42] 25 were treated by aspiration or drainage and antibiotics intravenously. The other 25 were treated in the same way with the addition of a single intravenous dose of a corticosteroid. There were significant improvements in the times to swallowing liquids and return to normal temperature, but an improvement in trismus in the corticosteroid group was not significant.

Mirvakili et al also conducted a randomised controlled trial of 50 patients with PTA.[14] One group was treated with aspiration or drainage and antibiotics intravenously. The other had similar treatment with the addition of a single intravenous dose of a corticosteroid. There were significant improvements in the times to discharge and return to normal temperature in the corticosteroid group.

Chau et al randomised 41 patients with PTA at two centres in Canada to treatment with aspiration, antibiotics intravenously, and placebo; or aspiration, antibiotics intravenously, and a single intravenous dose of a corticosteroid.[43] Significant improvements in pain at 24 hours had been lost by 48 hours, and a reduction in time to normal dietary intake was not significant.

In a retrospective case control study, Koçak et al compared incision and drainage, analgesia, antibiotics, and a single intravenous dose of a corticosteroid, with that of incision and drainage, analgesia, and antibiotics, in 32 patients. There were significant improvements in pain scores and mouth opening at 24 hours in the corticosteroid group, although this difference was lost by seven days. The duration of stay was reduced from 2.4 to 1.2 days when corticosteroids were used. [44]

Discussion

The papers included a wide variety of case series, cohort and case-control studies, as well as randomised controlled trials. Grade I evidence, however, related only to PTA, periorbital cellulitis, or pharyngitis, possibly because of the relative scarcity of cases of DNSI and supraglottitis. It is interesting that we found no trial of the addition of corticosteroids in patients with odontogenic cervicofacial infections, as so many of these infections have an odontogenic origin.[4,5]

Benefits of corticosteroids

The studies showed multiple benefits and few negative effects after treatment with corticosteroids. The improvements in outcome seem to relate to their anti-inflammatory effects. In DNSI, non-significant benefits included the relief of pain and trismus,[17] and improvements in torticollis and odynophagia.[18] The benefits noted in cases of supraglottitis and epiglottitis included a reduction in airway oedema (not significant), and a shorter stay in the ICU.[10] There were multiple benefits in cases of periorbital cellulitis, including a shorter hospital stay,[25–27] and faster resolution of oedema, chemosis, proptosis, and pain.[27] In cases of pharyngitis, pain in both children and adults was reduced in the short term,[29–38] and patients returned to normal activities more quickly.[32,37] There were also improvements in pain scores, mouth opening, return to normal temperature, and possibly in duration of stay, in patients with PTA. [14,41–43]

Side effects of corticosteroids

Few side effects were reported. Some children with periorbital cellulitis became hyperactive and could not sleep,[25,26] but the hyperactivity noted by Davies et al (n = 2/24) was in children who had previously been diagnosed with attention hyperactivity disorder, and only one of them required the corticosteroid to be stopped after three doses.[25] None of the children with insomnia (n = 1/28) or hyperactivity (n = 3/28) in the study by Chen et al had to stop the treatment.[26] No other negative effects were reported.

Some small case reports, however, have indicated potential negative effects of the use of corticosteroids when they are used without appropriate antibiotic and surgical management. Hisham et al reported a case of Ludwig's angina that was misdiagnosed as asthma and initially treated intravenously with hydrocortisone.[11] After an initial improvement, the patient worsened on day three, and tracheostomy, incision and drainage, and antibiotics intravenously were initiated, with good outcome. Murray et al described a patient with facial fractures who was given high-dose methylprednisolone (1 g/day) for optic neuropathy after open reduction and internal fixation (ORIF).[45] After six days of treatment the patient developed necrotising fasciitis and died soon afterwards. Bono et al described another case of necrotising fasciitis that developed after seven days of treatment with corticosteroids alone in a patient with PTA.[12] Whilst these case reports were not included in the systematic review because of their size, they highlight the pitfalls of failing to control the source of infection and treating it

appropriately. They suggest that there can be serious consequences if corticosteroids are used on their own, and show that antibiotics and operation remain key to the management of cervicofacial infections.

Type and dose of corticosteroid

Several corticosteroids were used (methylprednisolone, dexamethasomne, or hydrocortisone, all intravenously; prednisolone, or dexamethasone both orally; and unstated agents), but most studies described dexamethasone or methylprednisolone. Dexamethasone is a long-acting glucocorticoid (duration of action 36–54 hours) with a strong anti-inflammatory effect. It has an equivalent glucocorticoid dose of 0.75 mg, and was used at doses of 0.3 mg or 0.4 mg/kg in children, and 8 mg or 10 mg in adults. Methylprednisolone is an intermediate-acting glucocorticoid (duration of action 12–36 hours) with an equivalent glucocorticoid dose of 4 mg, and was used at doses of between 1 and 3 mg/kg (most commonly 1 mg/kg). In a 70 kg patient, such dexamethasone doses are equivalent to between 200 mg and 250 mg of hydrocortisone. Methylprednisolone doses equate to between 350 mg and 1050 mg of hydrocortisone.[46] This wide range of dose and the scarcity of adverse effects suggests a wide therapeutic index for corticosteroid treatment in cervicofacial infections.

The duration and timing of treatment varied, with the most conservative regimen starting corticosteroids orally when concentrations of C-reactive protein had returned to normal.[25] Most studies reported patients starting corticosteroids on admission, and this was the case for clinical studies on PTA, DNSI, pharyngitis, and supraglottitis. Studies on orbital cellulitis, however, tended to start them later: on day four in the trial by Pushker et al,[28] and on day two or three in the study by Davies et al.[25] The duration of treatment was shortest in the studies on PTA (most used a single dose on admission), and longest (seven days) for the treatment of parapharyngeal abscess.[17] Notably, a number of studies did not record the duration.

Many studies purport to use a "short course" of "high-dose" corticosteroid, the precise definition of which varies according to local practice. The most frequently used regimens published were equivalent to hydrocortisone 200–1050 mg daily (dexamethasone 8–10 mg, or methylprednisolone 1–3 mg/kg) for around seven days. This variation in practice is reflected in a recent audit of steroid administration in OMFS units,[6] and a national audit of current practice (unpublished).

Limitations

Our findings are limited by the paucity of papers on severe odontogenic cervicofacial infections. Tonsillar abscess and odontogenic abscess are the most common causes of these infections,[4,5] and whilst the use of corticosteroids in patients with peritonsillar abscess has been reported in four randomised controlled trials, there is a dearth of studies on their use in odontogenic infections. To our knowledge, the only publication in this field is the UK survey of practice that was conducted by the Maxillofacial Trainee Research Collaborative.[6]

The inclusion criteria could also be a potential weakness. We decided that we would focus primarily on deep bacterial infections of the neck and face, and we excluded evidence that related to superficial skin and mucosal infections. It could be argued that supraglottitis, epiglottitis, and pharyngitis are superficial infections of the oropharyngeal and hypopharyngeal mucosa, but given the frequency of airway compromise in cervicofacial infections of all types, we decided to include them, as they may have wider implications for oral and maxillofacial surgeons.

The lack of homogeneity between the outcomes measured, the corticosteroids used, and the type of cervicofacial infection being treated, made meta-analysis impossible.

In conclusion, our findings suggest that short-term use of high-dose corticosteroids, as an adjunct to antibiotics intravenously, and incision and drainage, is safe and effective in the management of various cervicofacial infections. Further investigation will show the potential benefits of the addition of these agents to standard treatments of patients with severe odontogenic cervicofacial infections.

Conflict of interest

We have no conflicts of interest.

Ethical approval/consent

No ethics approval necessary as the manuscript is a systematic review of published work. Only previously published information used.

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