

Presentation and Management Outcome of Childhood Corrosive Oesophageal Injury in Benin City

Stanley U. Okugbo, G. A. Anyanahun, C. A. Efobi, O. T. Okugbo¹

Department of Surgery, University of Benin Teaching Hospital, ¹Department of Basic Science, Benson Idahosa University, Benin City, Nigeria

Abstract

Background: Corrosive ingestion in children occurs usually at home and frequently results in debilitating strictures. Prevention and early intervention programs are very important for good outcomes. **Aims and Objectives:** This study aims at examining the immediate causative factors and problems of this subset of patients with a special focus on treatment and outcome. This study was to audit the management of patients in the paediatric age group who presented for treatment with history and sequelae of corrosive ingestion seen by the cardiothoracic unit of the University of Benin Teaching Hospital from January 2005 till December 2018. **Materials and Methods:** This is a 14year retrospective study of patients that presented with oesophageal burn injuries from ingestion of corrosive agents to the Cardiothoracic Unit at the University of Benin Teaching Hospital between January 2005 and December 2018. Essentially the first 5years were retrospectively included but the subsequent years were prospective. All available medical data on these patients were retrieved and studied for epidemiological, clinical and operative procedures and outcome. **Results:** A total of 49 patients were seen and admitted during the period under review. Male (29) : Female (20) ratio was 1:1.4 Mean age was 4.7±4.8 years with a range of 1-16years, The males presented earlier and had worse strictures as well as more surgical procedures. Caustic soda preparations ingested more (93.9%), all ingestions were within the household setting, and all had first aid given by way of oral palm oil. Only two (4.1%) ingested acids with only one flat battery ingestion. 45.5% of the patients had dilatation only and of these 50% recovered after 3 sessions and required no more sessions. A further 50% were lost to follow up. 38.8% had oesophageal replacement with colon following oesophagectomy. **Conclusion:** In conclusion, corrosive oesophageal stricture is a debilitating disease in children and affects males more, but it is treatable by multiple dilatations and oesophageal replacement with colon. Prevention should be actively pursued as well as early intervention.

Keywords: Corrosive ingestion, oesophageal injury, treatment outcome

INTRODUCTION

Corrosive strictures are increasingly distressing although preventable sequelae of oesophageal chemical burns.^[1] A common corrosive agent ingested that has been reported is caustic soda.^[1-3] In most poor economy, caustic soda is a readily available agent in the local production of soap.^[4] The local production of soap is regarded as a good source of income for homemakers and widows for whom better employment opportunities are lacking.^[4-6] Corrosive agents may be found in such homes as either soda lime crystals or reconstituted solutions for the local production of soap and may also be present in homes in bleaches, herbal preparations, pesticides, hair care products, etc.^[7,8]

Children are a vulnerable group of persons, needing special care and an attending adult to prevent them from harming themselves.^[1,3,8] Problems may result when the attending adult is inattentive to their welfare or negligent at minding them.^[7] Infants are usually speciously given either the crystals or reconstituted solutions to drink by incautious adults, or they may help themselves to the solution when thirsty as the solutions may not be properly packaged or placed within their reach.^[1,2,8] These children suffer a wide range of complications

Address for correspondence: Dr. Stanley U. Okugbo,
Department of Surgery, University of Benin Teaching Hospital,
PMB 1111, Benin City, Nigeria.
E-mail: stanleyokugbo@gmail.com

Received: 16-12-2010 Revised: 05-01-2011 Accepted: 19-04-2020 Available Online: 19-12-2020

Access this article online

Quick Response Code:



Website:
www.afripaedurg.org

DOI:
10.4103/ajps.AJPS_90_10

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Okugbo SU, Anyanahun GA, Efobi CA, Okugbo OT. Presentation and management outcome of childhood corrosive oesophageal injury in Benin City. Afr J Paediatr Surg 2020;17:74-8.

from the chemical burns, resulting in injury to the mouth, oropharynx, larynx, oesophagus and stomach and even intestines.^[3,8,9]

Scenarios of ingestion include

Specious ingestion

Attendants may mistakenly give thirsty children and even adults caustic solutions to drink.^[3,10] Children may also themselves mistake the containers containing corrosives for those containing drinking water and innocently ingest the contents.^[9] Toddlers and babies may pick up the salt crystals if found lying around.^[8]

Homicidal ingestion

Caustic ingestions may be forcefully applied by mobs, cultic groups to persons they wish to punish. This may be in the form of mob justice for perceived crimes or as punishments to gang members or opposing groups. Older children may ingest them in the bid to commit suicide. However, ingestion of corrosive agents for suicidal reasons is more common in adults.^[3,7,10,11]

Sequelae of burns

They suffer immediate burns to the mouth, pharynx, oesophagus and even stomach and intestines depending on the type, amount and concentration of corrosive agent ingested. Alkalis burns tend to be more extensive on the oesophagus with saponification, while acids tend to be more on the stomach because of the relative resistance of the oesophageal mucosa to acid. Corrosive agents with^[8] pH < 2 or > 12 penetrate the oesophageal wall to produce liquifactive necrosis. An eschar is then formed which helps to prevent further contact of the corrosive agent with oesophagus.^[11] However, in alkaline burns, the corrosive penetrates deeper through the wall and produce saponification, infarction and transmural necrosis and inflammation.^[11] The burn wounds may further extend in the presence of infection.^[3] If anxious parents or guardians induce emesis, double contact may occur with even more burns and inflammatory reaction. The larynx may be burnt, leading to upper airway injury and obstruction.^[12] The transit time is proportional to the injury sustained; thus, injuries are more common at the points of narrowing of the oesophagus, namely the cricoid, around the point of impression by the aortic arch and the lower oesophageal sphincter.^[12]

Natural history^[11]

First, there is odynophagia from the ulcers and oedema may result in dysphagia. The ulcers usually heal within 3 weeks with fibrosis and stricture formation.^[11] With stricture formation, dysphagia worsens, with resultant repeated aspiration of oesophageal contents leading to repeated aspiration pneumonitis and suppurative lung diseases. Total dysphagia would quickly lead to inanition except enteral feeding can be quickly re-established, either by dilatation or nasogastric tube placement or by feeding gastrostomy or jejunostomy.^[12,13]

Treatment depends on the extent of oesophageal strictures formed. It includes dilatations, rehabilitation with feeding

gastrostomy and construction of a neo oesophagus with colon, jejunum or stomach.^[7,14-16]

This study aims at examining the immediate causative factors and problems of this subset of patients with a special focus on treatment and outcome. This study was to audit the management of patients in the paediatric age group who presented for treatment with history and sequelae of corrosive ingestion seen by the cardiothoracic unit of the University of Benin Teaching Hospital from January 2005 till December 2018.

MATERIALS AND METHODS

This is a 14-year retrospective study of patients that presented with oesophageal burn injuries from ingestion of corrosive agents to the Cardiothoracic Unit at the University of Benin Teaching Hospital between January 2005 and December 2018. Essentially, the first 5 years were retrospectively included, but the subsequent years were prospective. All available medical data on these patients were retrieved and studied for epidemiological, clinical and operative procedures and outcome. For this study, all patients that presented with a history of ingestion of corrosives either acutely or with results of complications including buccal ulcers, upper respiratory symptoms, odynophagia, dysphagia or mediastinitis were included in the study. This excluded those for whom there was no evidence of oesophageal burns. Special attention was focused on their bio data, mode of presentation and time of ingestion before presentation (including proper documentation of delays), social environment, clinical features, treatments given and outcome. It included all patients who presented at the emergency unit or were referred to the surgical outpatient

Table 1: The gender distribution of the patient according to their ages, mode of presentation, type of corrosive and treatment given

	Female	Male	Total	P
Mean	6.6	3.5	4.7	
Std. Deviation	5.6	3.6	4.8	0.024
Median	4	2	3	
Number	20	29	49	
Percentage	40.8	59.2	100	
Presentation <2weeks	12	19	31	
Presentation >2weeks	8	10	18	
Total	20	29	49	
Acid ingestion	1	2	3	
Battery ingestion	0	1	1	
Caustic ingestion	19	27	46	
Total	20	29	49	
Multiple/long-segment stricture	9	16	25	
Single/mild stricture	11	13	19	
Total	20	29	49	
Gastrostomy	12	21	33	
Colon replacement	7	12	19	
Bougienage	12	18	30	
Gastric outlet obstruction	0	4	4	

SD: Standard deviation

clinic. The data were retrieved from their clinical records, theatre records and ward records. They were collated and entered into excel spreadsheets. Patients with incomplete records were excluded. In 2009 and 2012, the hospital had prolonged periods of strike actions by various cadre of staff which showed in the number of patients seen at the hospital.

For this study, children were taken as all patients who at presentation were 16 years or less.

The results were analysed with SPSS 21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). For simple descriptive statistics with significance taken as *P*-value <0.05.

RESULTS

A total of 49 patients were seen and admitted during the period under review. Male (29):female (20) ratio was 1:1.4; the mean age was 4.2 ± 3.7 years with a range of 1–16 years, modal age was 2-year and median age was 3. The males were younger and were more [Table 1].

Caustic soda preparations ingested more (93.9%), all ingestions were within the household setting and all had first aid given by way of oral palm oil. Only three (6.1%) ingested acids with only one flat battery ingestion. All acid ingestions resulted in gastric outlet obstruction [Table 2].

One of the older girls in the study was a suicidal attempt. All the others were inadvertent ingestion from incautious attendants or the children themselves. 90% of the patients had a living relative who makes local soap for sale. The others had neighbours who make soap for economic reasons. All the patients had palm oil in varying amounts given to the patients by the first responders. Other antidotes given included raw eggs in 12.5%, anointing oil 10% and coconut water 5%.

Emesis was also encouraged in our patients by the first responders. These measures served in many cases to aggravate the injury as the oesophagus is exposed to the caustics again and again. Quantifying the volume of corrosive ingested

was cumbersome and haphazard in the records; therefore, it was impossible to ascertain how this may have affected the outcome.

45.5% of the patients had dilatation only and of these 50% recovered after 3 sessions and required no more sessions. A further 50% were lost to follow-up.

Early support included adequate fluid resuscitation, antibiotics and analgesia including oral toileting.

All the patients had oesophagoscopy as part of the assessment of the oesophageal injury; these were preceded by prior barium studies to outline the oesophagus. The diagnosis of oesophageal stricture was based on barium swallow studies.

Figure 1 shows the histogram of the age distribution of the patients.

Figure 2 shows the male: female distribution of the patient according to their time of presentation.

Table 2: Antidotes given

Antidotes	Frequency (%)
Palm oil	49 (100)
Raw eggs	6 (12.2)
Anointing oil	4 (8.2)

Table 3: The frequency and percentages of the various epidemiological factors

	Frequency (%)
Inadvertent ingestion	48 (98.0)
Suicidal ingestion	1 (2.0)
Repeated oesophageal bougienage	19 (38.8)
Successful dilatation	14 (28.6)
Failed dilatation	18 (36.7)
Oesophageal perforation	4 (8.2)
Mortality (perforation)	2 (4.1)
Awaiting further management	4 (8.2)
Lost to follow up	8 (16.3)

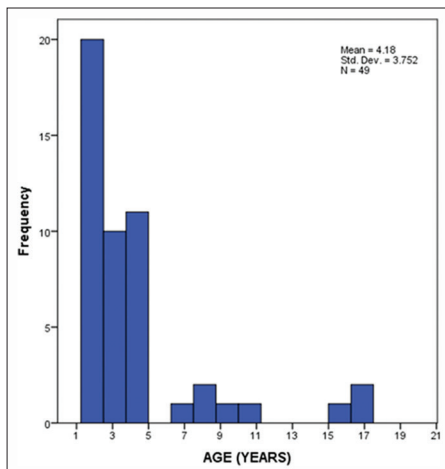


Figure 1: Shows age frequency distribution of patients

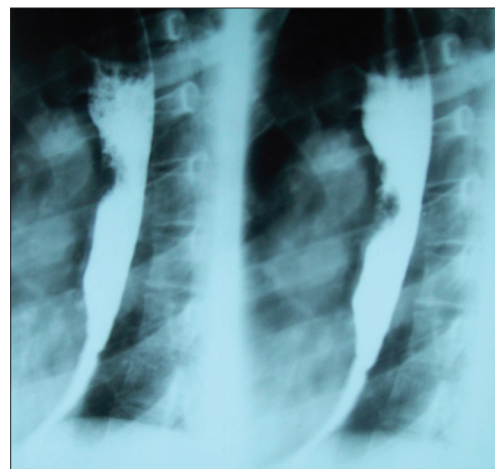


Figure 2: Showing a barium study with long segment stricture

Table 1 shows the frequency distribution according to gender cross tabulated against the time of presentation.

Table 2 is a composite table showing the frequency distribution of the causative agents and patients epidemiological presentations.

Table 3 shows frequency distribution of the management and outcome including the complications of all the patients in the study.

DISCUSSION

The management of corrosive burns should ideally start with prevention.^[1,2,7,9] This should start with legislation and training as well as education of those small entrepreneurs in society trying to eke a living by producing soap.^[5,10,17] Ideally, the caustic soda solution should be easily identifiable by careful labelling and storage. In many of the cases where the solution was given to children, the adults were neighbours or family members who were trying to help a thirsty child and simply misjudged the caustic solutions for drinkable water. If these solutions were oddly coloured or packaged differently from how drinking water is stored within those households, these injuries may have been prevented. Legislation addressing packaging and concentration of corrosive agents in household solutions (bleaches, etc.) has reduced the incidence of ingestion and burns in industrialised countries were in effect.^[3,11] However, in our setting in Nigeria, most of the ingestions have been from people involved in the local production of soap.^[2,3] Prevention in this setting would therefore require proper public enlightenment and education in the handling of these corrosive agents.^[2] Many governmental initiatives on poverty alleviation invariably involving soap making, nongovernmental organisations and religious bodies regularly conduct free economic empowerment programs, which invariably make these caustics available in the home since these indigent folks cannot afford a proper commercial centre for their soap making activity.^[4-6] Therefore, in the execution of these economic empowerment activities, it would be important to establish community industrial centres where these activities would take place to remove these hazardous substances from the home environments.

The reconstituted soda lime solution was the main corrosive ingested by 45 patients. Only one patient ingested the soda lime crystals which the child was said to have picked up from the floor where it was negligently left. The reconstituted soda lime solution looks much like drinkable table water ingested in most households; hence, it was speciously ingested in 45 patients. This is similar to other reports from Nigeria and Serra Leone.^[2,3,10] Although the concentration and pH was not assessed because the solutions were not brought to the hospital, the presence of multiple long-segment strictures suggests very high degree of oesophageal burns.^[12] All patients had red palm oil given to them as antidote. This follows a common local belief that palm oil is a good antidote to most ingested poisons. In a study done in the Niger delta

on childhood poisoning, they reported an incidence of 76.1% use of palm oil as antidote.^[18] Its effectiveness however requires further studies. The effect of palm oil as an antidote is not clear since the injuries sustained were still severe in many children. Topical application of mitomycin-C has been reported^[19] and its effect appears to be promising as it acts by the modulation of inflammation and cicatrisation whereas palm oil may produce its effect by way of neutralisation of the caustic agent.

Various studies have researched the effect of steroids on prevention of stricture formation, but the review by Pelclová and Navrátil showed that there is no significant benefit with routine use of corticosteroids in prevention of stricture formation in patients with chemical burns involving the oesophagus.^[20] Steroids were not used in our patients.

There were more males affected than females and they were more likely to be brought in earlier than females for treatment. The mean age of males in both early and late presentation seen was lower than that for females. Most studies corroborated that males are the predominantly affected demographic.^[2,3,10,11,21] The earlier presentation seen in our study may be due to the greater severity of the injuries seen in the males. The mean age of females presenting earlier was lower than those presenting late; the 2 older girls in the study who presented at 15 and 16 years, respectively, may explain this. They both presented late after using herbal preparations, consulting local chemists and private hospitals.

From our study, it would appear that males were more like to present early, had worse strictures and therefore more surgical procedures including feeding gastrostomy, oesophagectomy and colon replacement. This finding could be attributed to the males being more hyperactive and adventurous than the females. The more severe burns and injuries may have necessitated their presenting earlier or being brought quickly to the hospital, since this is not a population-based study; further work is needed to determine if male sex is a risk factor for children with corrosive strictures.

The average incidence was 3 new cases per year, but this seems to have had a peak of 9 in 1 year. Since this study only looked at those who were treated for oesophageal strictures, it does not represent all cases of ingestion of corrosives and it only reflects those who presented in our tertiary centre. Those with milder injuries may have been treated at the primary or secondary healthcare facilities or even at home or by traditional health-care providers. Thus, ours being a hospital-based study may only reflect children with severe injuries.

Colon replacement using the isoperistaltic left colon (pedicled on the left colic artery) is our standard practice as definitive treatment for undilatable multiple and long-segment strictures. The usual route is substernal. This is the same for other tertiary centres in Nigeria.^[3,22-24] This is usually preceded by transthoracic oesophagectomy to avoid the

small risk of oesophageal cancer on the redundant strictured oesophagus.^[10,12,25-28] This procedure is well tolerated and offers the best chance for long-term disease free survival. Others have reported the use of transhiatal oesophagectomy with gastric pullup.^[7,9] Though thoracotomy is a major undertaking in children, it was well tolerated in our patients. It essentially was a right sided serratus anterior sparing posterior lateral approach that was used.

As part of preparation for colon replacement, the children are usually rehabilitated with feeding gastrostomy. This allowed enteral feeding which improved their nutritional rehabilitation and quick recovery.

Multiple dilatations is a major treatment option in patients with short segment strictures <2.5 cm with luminal continuity.^[1,29,30] It usually involves multiple sessions using bougies or balloon dilators under rigid or flexible oesophagoscopy.^[7] It may be combined with local topical application of mitomycin-C.^[19] In a resource poor setting as ours, repeated dilatation is a big strain on the already impoverished families and we think that was responsible for the high default rate. Some of the children were simply abandoned by their parents when they were told to come for repeat barium studies, dilatation and readmissions. The management of long-segment strictures is fraught with complications and require timely interventions.^[31]

CONCLUSION

Corrosive oesophageal stricture is a debilitating disease in children and affects males more, with toddlers between 2 and 3 years at highest risk. Prevention should be actively pursued as well as early intervention.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Gupta DK, Srinivas M, Dave S, Lall A. An epidemiological survey on corrosive esophageal strictures in children. *J Indian Assoc Pediatr Surg* 2003;8:80-5.
- Adedeji TO, Tobih JE, Olaosun AO, Sogebi OA. Corrosive oesophageal injuries: A preventable menace. *Pan Afr Med J* 2013;15:11.
- Ekpe EE, Ete V. Morbidity and mortality of caustic ingestion in rural children: experience in a new cardiothoracic surgery unit in Nigeria. *ISRN Pediatr*. 2012;2012:210632. doi: 10.5402/2012/210632. Epub 2012 Jun 14. PMID: 22778986; PMCID: PMC3384939.
- Ekesionye EN, Okolo AN. Women empowerment and participation in economic activities: Indispensable tools for self-reliance and development of Nigerian society. *Educ Res Rev* 2012;7:10-8.
- Chikwendu E. Women, cooperatives and economic recovery in Nigeria. *Dialect Anthropol* 1997;22:353-71.
- Omofonmwan SI, Odi LO. The role of non-governmental organisations in community development: Focus on Edo State-Nigeria. *Anthropologist* 2009;11:247-54.
- Contini S, Scarpignato C. Caustic injury of the upper gastrointestinal tract: A comprehensive review. *World J Gastroenterol* 2013;19:3918-30.
- Contini S, Swarray-Deen A, Scarpignato C. Oesophageal corrosive injuries in children: A forgotten social and health challenge in developing countries. *Bull World Health Organ* 2009;87:950-4.
- Bonavina L, Chirica M, Skrobic O, Kluger Y, Andreollo NA, Contini S, *et al.* Foregut caustic injuries: Results of the world society of emergency surgery consensus conference. *World J Emerg Surg* 2015;10:44.
- Contini S, Scarpignato C, Rossi A, Strada G. Features and management of esophageal corrosive lesions in children in Sierra Leone: Lessons learned from 175 consecutive patients. *J Pediatr Surg* 2011;46:1739-45.
- De Lusong MA, Timbol AB, Tuazon DJ. Management of esophageal caustic injury. *World J Gastrointest Pharmacol Ther* 2017;8:90-8.
- Rafeey M, Ghojazadeh M, Mehdizadeh A, Hazrati H, Vahedi L. Intercontinental comparison of caustic ingestion in children. *Korean J Pediatr* 2015;58:491-500.
- Gün F, Abbasoglu L, Çelik A, Salman FT. Early and late term management in caustic ingestion in children: A 16-year experience. *Acta Chir Belg* 2007;107:49-52.
- Arul GS, Parikh D. Oesophageal replacement in children. *Ann R Coll Surg Engl* 2008;90:7-12.
- Contini S, Garatti M, Swarray-Deen A, Depetris N, Cecchini S, Scarpignato C. Corrosive oesophageal strictures in children: Outcomes after timely or delayed dilatation. *Dig Liver Dis* 2009;41:263-8.
- Stiff G, Alwafi A, Rees BI, Lari J. Corrosive injuries of the oesophagus and stomach: Experience in management at a regional paediatric centre. *Ann R Coll Surg Engl* 1996;78:119-23.
- Macdonald MR, Grace N. Caustic oesophageal burns in children. *Canadian Fam Phys* 1994;40:559-61.
- Ugwu GI, Okperi BO, Okolugbo NE, Ugwu EN. Childhood poisoning in Warri, Niger Delta, Nigeria: A ten year retrospective study: Case studies. *Afr J Primary Health Care Fam Med* 2012;4:1-5.
- Rosseneu S, Afzal N, Yerushalmi B, Ibarguen-Secchia E, Lewindon P, Cameron D, *et al.* Topical application of mitomycin-C in oesophageal strictures. *J Pediatr Gastroenterol Nutr* 2007;44:336-41.
- Pelclová D, Navrátil T. Do corticosteroids prevent oesophageal stricture after corrosive ingestion? *Toxicol Rev* 2005;24:125-9.
- Ogunleye AO, Nwaorgu GB, Grandawa H. Corrosive oesophagitis in Nigeria: Clinical spectrums and implications. *Trop Doct* 2002;32:78-80.
- Aghaji MA, Chukwu CO. Oesophageal replacement in adult Nigerians with corrosive oesophageal strictures. *Int Surg* 1993;78:189-92.
- Ezemba N, Eze JC, Nwafor IA, Etukokwu KC, Orakwe OI. Colon interposition graft for corrosive esophageal stricture: Midterm functional outcome. *World J Surg* 2014;38:2352-7.
- Eze JC, Onyekwulu FA, Nwafor IA, Etukokwu K, Orakwe O. Right colon interposition in corrosive esophageal long segment stricture: Our local experience. *Niger J Clin Pract* 2014;17:314-9.
- Ti TK. Oesophageal carcinoma associated with corrosive injury-prevention and treatment by oesophageal resection. *Br J Surg* 1983;70:223-5.
- Kim YT, Sung SW, Kim JH. Is it necessary to resect the diseased esophagus in performing reconstruction for corrosive esophageal stricture? *Eur J Cardiothorac Surg* 2001;20:1-6.
- Okonta KE, Tettey M, Abubakar U. In patients with corrosive oesophageal stricture for surgery, is oesophagectomy rather than bypass necessary to reduce the risk of oesophageal malignancy? *Interact Cardiovasc Thorac Surg* 2012;15:713-5.
- Csikós M, Horváth O, Petri A, Petri I, Imre J. Late malignant transformation of chronic corrosive oesophageal strictures. *Langenbecks Arch Chir* 1985;365:231-8.
- Abaskharoun RD, Depew WT, Hookey LC. Nonsurgical management of severe esophageal and gastric injury following alkali ingestion. *Can J Gastroenterol* 2007;21:757-60.
- Broor SL, Raju GS, Bose PP, Lahoti D, Ramesh GN, Kumar A, *et al.* Long term results of endoscopic dilatation for corrosive esophageal strictures. *Gut* 1993;34:1498-501.
- Inuwa IM, Ismail JA, Oyeibanji NT, Anyanwu LJ, Aji SA, Mohammad MA, *et al.* Management of long segment corrosive esophageal stricture in children and adults: A 5 years' review. *J Clin Sci* 2019;16:81.