High Serum Levels of Silver in a Paediatric Burns Patient Managed with Silver Dressings Does Not Equate to a Clinical Disaster

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Introduction

Argyria is a rare disease caused by the chronic absorption of products with a high silver content which surpass the body's renal and hepatic excretory capacities, leading to silver granules being deposited in the skin and its appendages, mucosae and internal organs (including the eye, kidney, spleen, bone marrow and central nervous system), and causing them to acquire a blue-grey pigmentation[1]. There have also been reports of systemic effects if silver is used inappropriately[2]. Fears of iatrogenic argyria have led to cautious use of silver impregnated dressings in the paediatric population. The aim of this study was to discuss a case where high serum levels of silver in a paediatric burns patient did not have any clinical adverse outcomes and to review if there is any literature to support argyria-like symptoms or toxicity in the paediatric burns population attributed to high levels of silver due to topical silver dressings.

Case Report

A 9 year-old-boy sustained 91% TBSA full thickness flame burns. He was managed according to protocol, with early resuscitation and escharotomies. Burns wounds were then managed with debridement and Integra™ (Life Sciences Corp), followed by twice weekly dressing changes with Acticoat™ (Smith & Nephew). An informal discussion regarding the use of silver dressings in a different patient sparked the debate of whether silver toxicity from topical application could be founded. Due to the size of the boy's burn, even though he had no signs of toxicity, his serum silver levels were measured. His serum silver level was 1,286.7 nmol/L (normal <3) almost 8 months into his admission with no associated other biochemical or clinical abnormalities. As he was well and his burns wounds were showing good progression, in discussion with his family the decision was made to continue with the same dressing regime. He was discharged after 10 months clinically well with planned follow-up of neck contractures and hypertrophic scarring. He at no point showed any abnormality associated with silver toxicity.

Table 1: Reports of high serum levels of silver or silver toxicity related to dressings in a paediatric burns patient.

Paper	Publica-tion type	No. of patient (s)	Age	Burn (% TBSA)	Dressing	Duration of dressing (mean if approrpia-te)	Results	Conclusion
1[3]	Retrospective review	8	23 – 25 weeks gestation (average not stated)	1 – 30	Acticoat One received Silvazine	-	<0.05 µmol/L (*n*=2) and 1 µmol/L (*n*=1).	No associated toxicity
2[4]	Retrospective review	46	Prematurely born to 12-year-old (average not stated)	0.5 – 40 (average not stated)	Acticoat 12 had received SSD for 1 to 2 days and one for 8 days elsewhere before using Acticoat.	Acticoat: 18.5 days (4-105 days)	36 patients with a mean of 13.4% TBSA burns had a mean peak serum silver level of 114 g/L, whereas 10 patients with a mean of 1.85% TBSA burns had an undetectable level of silver (<5.4 g/L)	No associated toxicity
3[5]	Case report	1	3 year-old	60	Topical application of a mixture of SSD and nystatin	67 days	Cyclical nature of elevated serum lactates; peaking 6 hours after dressing change	Lactic acidosis
4[6]	Case report	1	17 year-old	30	Acticoat	6 days	The silver levels in plasma (107 µg/kg) and urine (28 µg/kg) were clearly elevated, associated with raised liver enzymes.	Silver toxicity

Literature Review Results

A comprehensive search of the literature was undertaken with a focus on either clinical signs of silver toxicity or elevated serum levels of silver in a paediatric burns patient due to silver dressings. Only four papers reported on high levels of silver with no associated toxicity (*n*=2) or temporary lactic acidosis attributed to topical silver dressings (*n*=1). There was only one report of high levels of silver due to dressings with argyria-like symptoms in a 17 year-old-boy[5], but the relatively sudden onset of discoloration suggests an abnormal metabolic response.

Discussion

Silver ion has been employed as an antimicrobial for several millennia and since the 1960s, silver dressings have become the mainstay in burns dressings. What we know about the safety of silver impregnated dressings mostly comes from the adult population. Silver dressings are considered safe alternatives to other topical antimicrobial agents and the general consensus appears to be in support of using silver in the management of chronic and burn wounds, despite the occasional concern with regard to toxicity and background levels of free radicals[5]. Adverse effects are almost always related to inappropriate use, such as oral ingestion of colloidal silver solutions[8]. Ionized silver is safe when used in appropriate moisture-balance dressings and releases substantially less silver than found in silver sulfadiazine cream or colloidal silver products and there is a very high margin of safety for even the high release silver dressings[2]. The use of Acticoat™ has not changed in our Hospital's protocol and we do not routinely check serum silver levels.

Conclusion

This case highlights that high levels of serum silver due to silver impregnated dressings may not lead to any clinical problems. Silver remains an important part of our armament against burn wounds. Further robust investigations with a scientific approach are needed however to determine best practices related to the long-term use of silver-impregnated dressings in the paediatric population.

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