



Original Research

Eye Injuries of the Traditional Mining Hand Workers in the Gold Panning Sites of Niger

Les traumatismes oculaires chez les mineurs traditionnels au Niger

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HIGHLIGHTS

What is already known on this topic

Poor working conditions lead to many health hazards in artisanal gold mining. However, data on the extent of the problem are scarce.

What question this study addressed

Frequency and severity of traumatic eye lesions of artisanal gold miners in Niger.

What this study adds to our knowledge

Eye injuries are severe and often associated to maxillofacial injuries and limb fractures. The visual prognosis is nearly always poor.

How this is relevant to practice, policy or further research.

Proper working conditions and adequate tools are mandatory. Health and safety training should be implemented.

ABSTRACT

Introduction. Mining hand workers are exposed to numerous hazards due to lack of working tools. The aim of study is to describe the eye diseases of the traditional mining hand workers in the gold panning sites of Niger. **Methods.** Over 18 months, we collected 36 eyes that were victims of trauma among Niger traditional gold panners. Our data of interest were the sociodemographic data, the type of lesions, the management and the outcome. **Results.** The lesions were bilateral in all cases but asymmetrical and affect one or more structures of the eye and its adnexa. The presence of multiple foreign bodies was seen in all eyes, we found 9 cases of bursting of the globe requiring immediate evisceration. Other systems were also affected: 55% of maxillofacial injuries and in 27% limb fractures. The visual prognosis was poor in 94.43% of the cases. The lack of adequate management infrastructures and the improper handling of homemade explosives are at the origin of the accidents responsible for these traumas. The absence of first aid structures and the lack of means of transportation further complicate serious cases. **Conclusion.** Substantial health and safety training should be considered, as well as apprenticeship to help workers understand the dangers and how to reduce the risks to which they are exposed.

RÉSUMÉ

Introduction. Le mineur artisanal est exposé à plusieurs risques du fait d'outils de travail inadaptés. Ce travail a pour but de décrire les lésions oculaires des mineurs traditionnels dans les mines d'or traditionnelles du Niger. **Patients et méthodes.** Nous avons colligé sur une période de 18 mois 36 yeux ayant été victimes de traumatisme chez les orpailleurs clandestins du Niger. **Résultats:** les atteintes étaient bilatérales et touchaient une ou plusieurs structures de l'œil et ses annexes. Des corps étrangers multiples étaient présents dans tous les cas. Nous avons retrouvé neuf cas d'éclatement du globe ayant nécessité une éviscération d'emblée. Les lésions des autres systèmes étaient maxillo-faciales dans 55% des cas et dans 27% des cas, il y avait des fractures de membres. Le pronostic visuel était mauvais dans 94,43% des cas. Le manque d'infrastructures d'exploitation adéquates, la mauvaise manipulation des explosifs artisanaux étaient à l'origine de ces traumatismes. **Conclusion.** Du fait de la sévérité des lésions, des outils de travail adaptés doivent être utilisés. En outre, une formation adéquate dans les domaines de la sécurité au travail et la manipulation sont nécessaires pour réduire les risques professionnels chez les orpailleurs artisanaux au Niger.

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INTRODUCTION

The artisanal gold mining is a reality in Niger, this field is recently explored by the stranded young peoples in their desperate search for job exposing them to several dangers including in the health sector. The looting of gold deposits by illegals miners are seen on the outskirts of authorized mines but also in complete autonomy, sometimes in the old deposits [1]. Being a force requiring job, gold panning is responsible of many accidents. Thus, there are falls and collapses, as well as accidents due to improper handling of tools or dangerous products (explosives, toxic products), to which are added the dust released from the machines which attempted to the health of artisanal gold miners, the development of diseases and epidemics due to the lack of hygiene, the harsh climate and the lack of protection [2]. The consequences on health are dramatic. Concerning the eyes, the damages are dramatic and devastating, ranging from superficial adnexal wounds to the complete rupture of the globe, in all cases the prognosis remains severe. We present in this work the eye lesions found in patients who were victims of an explosion in the gold mines in Niger.

PATIENTS AND METHODS

We collected a total of 18 patients over a 15-month period from January 2019 to March 2020. All the patients were male and all came from the Komabangou gold mine in the Tillabery region in the far west of Niger. We studied the socio-demographic aspects, the ocular lesions, other associated lesions, the treatment provided and the visual prognosis of the affected eyes. A survey sheet served as a collection support..

The study was approved by the ethics committee of the ministry of health institutional review board, and all the methods were carried out in accordance with the Helsinki guidelines and declaration. Informed and signed consent for publication of data and images were obtained from patients and patient’s parents or legal guardians for minors.

RESULTS

Our sample consisted of 36 eyes from 18 patients, all male, ranging in age from 16 to 42 with an average age of 28. Among them 13 patients were out of school and 5 had a primary level. All of the patients were in illegal gold mining and none had any other means of support. The trauma was secondary to the explosion of homemade grenades in 15 cases (83.33%) and by collapse of the deposits in 3 cases or 16.67%. Eye injuries by structures are listed in the **table I** below

Lesions by structure	Right	Left	Both
Eyelid wound	3	10	5
Multiple corneal foreign bodies	18	18	18
Corneal wound	3	7	3
Scleral wound	1	4	2
Corneo-scleral wound	2	2	0
Corneal wound + traumatic cataract	1	3	0
Shattering of the globe	5	4	3

The damage was bilateral in all cases but readily asymmetrical and affected one or more structures of the eye and its adnexia, the presence of multiple foreign bodies was seen in all eyes.

Table II: Associated damage of other systems

Damage	Number	Percentage
Ocular and cerebral	2	11,11
Ocular and maxillofacial	10	55,55
Eye and limb fractures	5	27,77
Eye and body burn	1	5,55

Ten patients (55.55%) had associated maxillofacial lesions.

Table III: Management of lesions

Treatment	Number of affected eyes
Suture of wounds	32
Suture and cataract extraction	4
Corneal transplant	2
Enucleation	3
Evisceration	9
Foreign body ablation	36

Table IV: Visual prognosis based on visual acuity

Visual acuity	Number of affected eyes	%	Visual prognosis
No Light perception	12	33,33	Bad
Light perception	14	38,88	Bad
Counting fingers	8	22,22	Poor
1 m – 5 m			
1/10 - 3/10	2	5,55	Moderate
More than 3/10	0	0	None

In 94.43% of the eyes the visual prognosis was poor with 72.21% of irreversible blindness.

DISCUSSION

Mining work even under optimal conditions exposes to enormous dangers in various field and on health in particular. All the steps in this profession present different degree of risk: drilling, explosives, the chemicals used and sometimes even the metals explored. The risk is considerable and the young population, especially the male population, are the most affected. In this study all the patients were male, certainly because of the local tradition of defending women from mine work. This male predominance is found (100%) in the study of Waqar MuzaVar et al. [3], E. Kyeremateng-E.A et al. also found 97% of men [4]. Other African studies have provided significant proportions of women in the mining sector [5]. The young age of the victims is also unanimous in the literature [3-7]. The trauma is mainly due to explosives, toxic substances used and the collapse of mining digs. In this series 83.33% of injuries were secondary to the improper handling of explosive devices, our figures are lower than those of Waqar Muza Var et al. who found 89.2% of eye damage due to explosions, meanwhile Kyeremateng.E.A et al. found 12.5% of cases due to collapses of digs and 9.8% following wrong manipulation of explosives. Although in many

studies the most listed lesions were not ocular our interest in this series is mainly focused on ocular lesions. We found 55.55% of maxillofacial damage and 27.77% of limb fractures associated to ocular damage, which makes these patients poly-morbid. Two patients had brain damage (a hematoma and a foreign body in the brain parenchyma). The management of these patients was in collaboration with the maxillo-facial surgeons, the traumatologist and neurosurgeons.

In the injured eyes several structures are often damaged as shown in **Table I**. The most exposed part is the cornea, at this level the lesions caused by these explosive devices are mainly associated with multiple encrusted fragments and partial and / or full thickness irregular corneal lacerations requiring extensive suturing and debridement. The involvement of the cornea is very serious because being a transparent and refractive medium, its modification is necessarily linked to a certain decrease in visual acuity. In this present study, all our patients had intra-corneal foreign bodies in both eyes, corneal wounds were seen in 18 eyes, ie 50%, 50.5% of corneal lacerations were reported by MuzaVar et al. [3]. The rupture of the globe leading to evisceration was seen in 9 cases in our series, 23.1% of the cases in the study by MuzaVar et al. have had the same surgery. There were wounds of the eyelids in 13 eyes or 36.11%, 62.6% of MuzaVar patients had lacerations in the eyelids. The damage was bilateral in all cases but willingly asymmetrical and affected one or more structures of the eye and its annexes. The presence of multiple foreign bodies was seen in all eyes, our findings are higher than those in the literature which range from 50–72% [3, 8-11]. The blindness rate (as defined by the WHO) in this study is of 94.43%, this rate is higher than those in the literature which ranges from 74–75% [9, 10, 12]. This severe prognosis could be explained by the fact that the local miners in Niger are very vulnerable having no means of protection (exposing them to extensive and very serious lesions) and no first aid available (late treatment and high rate of infections and complications).

Informal work like that of the clandestine mining generally concerns young adult males as seen in this series, the high percentage of morbidity makes this a real public health problem and therefore must be the subject of particular attention. It is estimated that 20-30 million miners are involved in informal mining worldwide, most of whom are in low-income countries like ours [4]. The safety and health risks to which these workers are exposed concerns not only themselves, but also their families and the surrounding communities. Infrastructure and facilities for security and health are scarce or nonexistent.

The challenge for policy makers, health and safety professionals, workers' organizations, community organizations and other non-governmental agencies, is to develop inclusive, appropriate and workable strategies, with the ultimate goal of protecting informal workers. The labor inspectorate should be modernized and more resources should be provided to supervise and support work in informal mines. Frequent and substantial health and safety training should be considered as well as regular training

to help workers understand the dangers and how to reduce the risks.

CONCLUSION

The loss of vision to a hand worker is an irreparable disaster, they become of no use to themselves and a big burden to the society. The high rate of blindness and co-morbidity found in this study shows the precariousness of this sector. The eye is the subject of several types of lesions, sometimes with a very poor prognosis, and their management would imply multidisciplinary. The modernization of this sector and the installation of eye protection devices could help reduce the incidence of these accidents.

DECLARATIONS

- **Conflicts of interest:** none
- **Ethics approval and informed consent:** The study was approved by the ministry of health ethical board comity and informed consent of all patients was obtained for this study.
- **Availability of data and materials:** all data are available on request.
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- **Authors contributions:** ABBA KAKA H.Y: main author, participated to all steps of the article: elaboration of study protocol, methodology formulation, collection of datas, datas analysis, script writing and submission. MOUSSA M: protocol conception, datas collection and analysis, review of the manuscript. GUIROU N: protocol amendment, article review. BOUBACAR M: datas collection and manuscript review. ROUFAYE L: datas collection and manuscript review.
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