Trauma of the hand from circular saw table: a series of a 130 cases

La main de toupie : à propos de 130 cas

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RÉSUMÉ

Introduction: Les traumatismes par toupie sont fréquents dans les pays en voie de développement, spécialement en Tunisie, à cause du non-respect des mesures de sécurité, engendrant souvent des lésions graves et complexes chez de jeunes travailleurs manuels.
Objectifs : Dans ce travail, on s'est proposé comme objectifs d'étudier les caractéristiques épidémiologiques, la prise en charge, et les séquelles des traumatismes de la main par toupie afin de dégager les moyens de prévention d'un tel accident.
Méthodes : Etude rétrospective de 8 ans d'une série de 130 patients.
Résultats : L'âge moyen était de 31.24 ans, 62% étaient des apprentis non qualifiés, le côté gauche était presque deux fois plus atteint que le droit. Sur le plan clinique, les lésions étaient pluri digitales dans 77% des cas. Dans la moitié des cas, l'atteinte a touché la peau dorsale de la main. Concernant la prise en charge chirurgicale, la régularisation de moignon était le geste le plus pratiqué en urgence. Les arthrodèses, les plasties cutanées et les apports spongieux étaient les gestes les plus fréquemment réalisés secondairement (79% des cas). La raideur articulaire était la complication la plus fréquente (26% des cas).
Conclusion : Nous insistons sur la fréquence, la gravité, le taux important d'invalidité causées par un tel traumatisme. La prévention est primordiale, et ce par le Page 4/25 Tunisie Médicale biais de la formation et de l'information des jeunes apprentis ainsi que par l'application de mesures de sécurité adéquates et l'amélioration des conditions de travail.

Mots-clés
Main, toupie, facteurs de risque, prévention.

SUMMARY

Introduction: Trauma of the hand from a circular saw table is a common occurrence in developing countries it tends to occur in young hand working people and it causes a serious lesions.
Materials and methods: It was a retrospective series about a 130 cases of hand trauma from circular saw table.
Epidemiological features, treatment, and permanent disabilities left by hand trauma from circular saw table were studied to identify ways to prevent such an accident.
Results: The average age was 31.24 years, these patients were exclusively men, 62% were apprentice wood workers, and the left hand was twice more injured than the right hand. Regarding clinical aspects, in 77% of cases, two or more fingers were injured, tip amputations of the left fingers predominated (49%), in 50% of the cases of hand wounds occurred to the dorsum of the hand, and extensor tendon injuries were observed twice more than flexor tendon injuries.
Regarding the surgical treatment, performing an amputation stump was the most practiced primary surgery (107 cases i.e. 82% of primary surgeries). Arthrodesis, reconstructive flap surgery, and spongy bone grafts were the most practiced secondary surgeries (79% of secondary surgeries). Joint stiffness was the most observed complication (26%).
Conclusion: Hand injuries from circular saw table such as those described in this study will continue to challenge the skill of surgeons devoted to the restoration of function and form to the damaged hand. Prevention, of course, should be the goal because of the severe functional and psychological impairment that may result from them.

Key-words
Hand, Hand injury, circular saw table, risk factors, prevention.

Introduction: The hand, most important tool for mankind, is often exposed to traumas especially at work that is why hand injuries are considered to be the most frequent body injuries. Hand traumas from circular saw table are frequent in our developing countries and could lead to serious functional and psychological impairments. The management of such injuries is difficult and costs more to society than the application of appropriate preventive measures [1, 2, 3].

METHODS

It was a retrospective study, about a 130 cases of hand traumas from circular saw table, led in Mahdia's orthopedics' and traumatology department between 2005 and 2013. All patients who first consulted emergency department and then treated and followed up in Mahdia's orthopedics and traumatology department were included in the study. Patients seen and treated in second hand were excluded from the study.

RESULTS

1) Epidemiological results:

During the study period, 21% of patients that were hospitalized for work accident in our department were hand traumas from circular saw table (Table 1). The average age was 31.24 years with a range of 16 to 67 years. More than a half of these traumas occurred in young people under 30 years with a peak of incidence between 21 and 30 years, and it decreased with age (Figure 1).

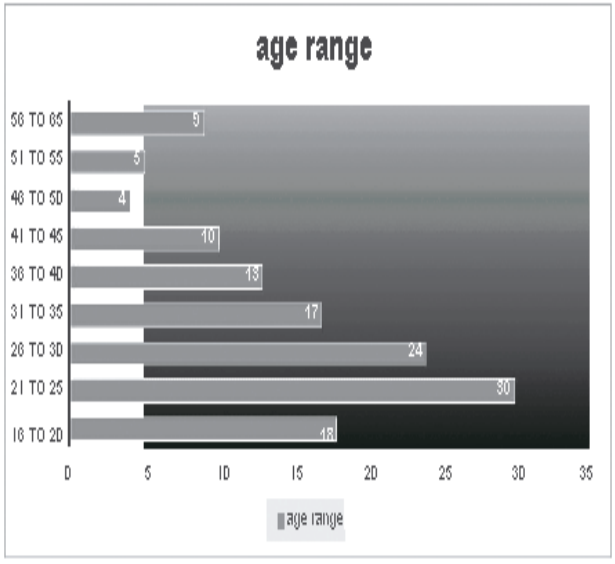

Figure 1: age range of our patients

Table 1 : Percentage of hand traumas from circular saw table among all hand traumas hospitalized between 2005 and 2013

	Number	percentage
Patients hospitalized in our department for work accident	805	100%
Traumas from circular sawtable	170	21%
Patients included in the study	130	16%

Our study population was only made of men. 62 % of those accidents concerned non-qualified apprentices; only 38 % of our patients were qualified carpenters. 92% of our patient were right handed (120 patients) however, 64.61% of the injuries concerned the left hand (84 patients), and a bilateral hand trauma was observed in only one case. The work hour appears also to be an important factor to notice, in fact, there were two peaks of incidence: 27 cases of injuries were sustained between noon and 2:00 p.m., and 27 cases were sustained between 4:00 p.m. and 6:00 p.m (figure 2).

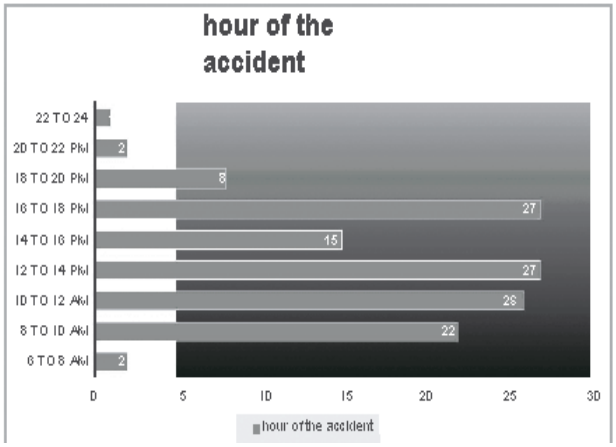

Figure 2 : hour of the accident

2)Clinical study:

Seventy-seven per cent (77%) of our patients had two or more than two fingers injured, the association of two or three injured fingers was observed in 54% of cases, and the trauma of all fingers was observed in 9% of cases. The most injured finger was the index and the middle finger (Table 2).

Table 2: Repartition of the finders' injuries

	thumb	index	Middle finger	Ring finger	Little finger	total
Left	31	64	69	45	27	237
right	12	25	36	38	27	138
total	43	89	105	83	33	375
percentage	12%	24%	28%	22%	14%	100%

Finger amputations were the most common lesions (85%), and it concerned more the left hand (62%) than the right one (38%).The index and the middle finger were the most amputated ones (52% of all finger amputations), although, the thumb was amputated in only 5% of cases. Regarding the hand side, the index and the middle finger were the most amputated fingers in the left hand (66% of all finger amputations); however, regarding the right hand the ring and the little fingers were the most amputated ones (34% of all finger amputations) (Table 3).

Table 3: Repartition of amputations in each finger

	thumb	index	Middle finger	Ring finger	Little finger	total
left	4	25	27	13	7	76
right	2	9	7	13	16	47
total	6	34	34	26	23	123
percentage	5%	27,5%	27,5%	21%	19%	100%

Also it is important to notice that the majority of amputations occurred in the distal interphalangeal joint (49%) (Table 4 and 5). The hand wounds were also analyzed, in fact, cutaneous lesions occurred in 50% of cases to the dorsum of the hand (Figure 3). Then, regarding the tendon lesions, the hand extensor system was injured in 69% of the cases of tendon lesions in the right hand, and it was a substance loss of the tendon in 92% of cases, and in 53% of cases of tendon lesions in the left hand, and it was a substance loss of the tendon in 86% of cases (Table 6 and 7).

Table 4: lesional level of the amputations in long fingers

	Third phalanx	Second phalanx	First phalanx	Metacarpo phalangeal	Proximal inter phalangeal	Distal inter phalangeal	total
index	12	8	4	2	3	5	34
Middle finger	17	8	4	1	2	2	34
Ring finger	16	6	2	0	0	2	26
Little finger	12	6	4	0	0	1	23
total	57	28	14	5	5	10	117
percentage	49%	24%	12%	4%	4%	8%	100%

Table 5: lesional level of the thumb

Lesional level	Right thumb	Left thumb	total
Second phalanx	1	3	4
Inter phalangeal	0	0	0
First phlanx	1	0	1
Metacarpo phalangeal	0	1	1
total	2	4	6

Table 6: tendon lesions regarding the right hand

		thumb	index	Middle finger	Ring finger	Little finger	TOTAL	%
Extensor system	With cutaneous defect	3	6	11	5	5	30	63%
	Without cutaneous defect	0	1	0	2	0	3	6%
Flexor superficialis tendon	With cutaneous defect	0	2	4	2	0	8	16%
	Without cutaneous defect	0	0	0	0	0	0	0%
Flexor digitorum profondus	With cutaneous defect	0	1	4	1	0	6	13%
	Without cutaneous defect	0	0	0	0	0	0	0%
flexor	**pollicis longus**	1						2%

Table 7: tendon lesions regarding the left hand

		thumb	index	Middle finger	Ring finger	Little finger	TOTAL	percentage
Extensor system	**Avec PDS**	5	14	20	9	4	52	47%
	Sans PDS	1	1	1	3	0	6	5%
Flexor superficialis tendon	**Avec PDS**	1	7	4	4	4	20	17%
	Sans PDS	0	0	2	1	0	3	3%
Flexor digitorum profondus	**Avec PDS**	1	6	8	4	5	24	22%
	Sans PDS	0	1	2	2	0	5	4.5%
flexor	**pollicis longus**	2						1.5%

In the case of hand bones lesions (fractures and or bone loss), long fingers were more injured than the thumb (155 fractures of long fingers vs. 18 fractures of the thumb), middle and distal phalanges were the most fractured ones (80% of cases in the right hand and 78% in the left one), it is also interesting to notice that the right ulnar sided fingers (53 cases from 73 bone lesions in the right hand) and left radial sided fingers (67 cases from 102 bone lesions in the left hand), were the most concerned ones. Finally, regarding the joint lesions, the right distal interphalangeal joints were the most injured ones (59% of

all joint lesions), however, in the left hand distal and proximal interphalangeal joints were injured with the same frequency (43% for each one).

3) Surgical treatment:
Performing an amputation stump was the most practiced primary surgery (107 cases, i.e.: 82% of all primary surgeries), the middle finger was the most concerned one (33 cases, i.e.: 30% of all primary surgeries) but the thumb was concerned in only three cases. Then, skeletal fixation was performed through axial pinning in 76 cases (table 8).

Table 8: primary surgeries

	thumb	Index	Middle finger	Ring finger	Little finger	total
Axial pinning	10	19	22	14	11	76
Cross pinning	2	2	2	1		14
External fixation	1	1	3	2	0	7
orthesis	3	3	5	6	2	19
Amputation stump	3	26	33	25	20	107
Tendon suture	4	12	16	7	3	42
Nerve suture	2	2	0	2	0	6
Nail reposition	4	3	3	4	1	15
Pulp reposition	1	0	3	4	0	8
Spogy bone grafting	0	1	3	0	1	5
replantation	0	0	0	0	0	0
Medical wound management	0	4	5	3	2	14

Regarding the secondary surgeries, 52 patients (40%) were reoperated, the most performed secondary surgeries were: arthrodesis, reconstructive flap surgery, and spongy bone grafting (34 cases i.e.: 65.4% of all secondary surgeries). Arthrodesis was performed at most on the proximal inter phalageal joint of the index (6 cases) and of the middle finger (4 cases) (Table 9).

4) Hospitalization duration and post-operative care:
The average hospitalization duration was about 2.71 days with a range of 1 to 18 days, 21 patients were hospitalized for 14 days, and 76.9% of patients were hospitalized for two or less than two days. 13 of our patients (10%) never consulted after leaving hospital, 84 patients (64.6%) were followed for more than a month. The average sick leave duration of our patients was about 65.91 days with a range of 17 to 360 days. The rate of permanent partial disability was between 6% and 70% with an average rate of 18.23 percent (this rate was only gathered in 39 patients).

Figure 3 : an illustration of trauma of a hand from circular saw table

DISCUSSION

Hand, the first tool of mankind represents only 1% of total body surface area. Its use in all activities increases its exposure to trauma and that is particularly frequent and severe in woodworking indust. young and less experienced users are at particular risk [2, 4-6]. Circular saw table is a machine using a toothed metal cutting disc used to cut wood. Usually the saw is fixed and the wood piece to be cut is slowly moved into the saw blade by the right hand while the left one is placed behind and nearest the blade to pick up the smaller piece of wood sawn off.
According to our series and to literature hand trauma from circular saw table is a common occurrence in developing

Table 9 : secondary surgeries

	Spongy bone grafting	arthrodesis	Cutaneous plasty	pollicisation	Bone elongation	Composite flap	arthroplsty	Banana split plasty
Thumb	0	0	4	0	0	0	0	0
Index	1	9	0	0	0	0	0	1
Middle finger	3	7	3	0	0	0	1	0
Ring finger	0	4	1	0	1	0	0	0
Little finger	1	1	4	0	0	0	0	0
Total	5	21	11	0	0	0	1	1
percentage	13%	54%	28%	0%	0%	0%	3%	3%

countries [2]. It tends to occur exclusively in men, because in our country, woodworkers are only men. Also, fatigue, hypoglycemia and post prandial somnolence are factors that could explain the frequency of occurrence of such accidents between noon and 2:00 p.m. and between 4:00 p.m. and 6:00 p.m. [6]. The high number of young people affected could be sorted out for the fact that the majority of woodworkers in our country are non-qualified young people [5].

Likewise, hand dominance was not a factor in injury [2]. Left hand was the most injured one, because it is often placed behind and nearest the blade to pick up the smaller piece of wood sawn off, a kick back or inattention in moving the left hand past the blade can readily result in injury, although, the right hand is used to push the wood through the blade and is usually between the blade and the fence, unless a narrow piece of wood is being ripped, the width of the piece provides some "distance protection" from the blade [2,5].

Lesions from circular saw table are usually contuse, soiled, multiple and complex. Most of cutaneous lesions were to the dorsum of the hand because the skin of the dorsum is thin, and bones and extensor tendons are directly under the skin, this fact could clear the frequency of bone and extensor tendons lesions. The predominance of bone lesions in the radial sided fingers of the left hand could be explained by the fact that the worker pushes the wood piece using the right hand which exposes the ulnar sided fingers to the saw blade and guides it using the left hand which exposes the radial sided fingers to the saw blade, these ascertainments were related by other authors. [6, 7].

Despite progress in hand surgery, plastic surgery and microsurgery injuries such as described in this study will continue to challenge the skill of surgeons devoted to the restoration of function and form to the damaged hand, and there treatment is still until our days disappointing.[5].

Also, one of the factors that could condition the therapeutic approach to adopt, is the fact that many workers in our country don't have any health social security so they have to pay all care costs, that is why they generally refuse to undergo sophisticated surgery that could lengthen there hospitalization duration and ask for simple surgeries so they could resume quickly there "livelihood" activity. Consequently, amputation stump performing was the most practiced primary surgery.

The average sick leave duration was about 65.91 days (i.e.: 2.2 months), this fact reflects also the severity of such an accident, that would be better prevented than cured.For most woodshops, workstations are often poorly designed. Also, when the work cadence is accelerated, most workers remove the security system.

A failure of the security system or a defective machines' maintenance are also important risk factors [2]. Likewise, at the thrust of wood pieces, proper orientation of the wood fibers in the same direction allows avoiding splinters, and the presence of dry nodes through wood pieces is also one of the most important threats [2]. At last, inattention and the absence of work qualification are too important risk factors [2]. The absence of security systems is the most important risk factor of such a type of accidents [2], that is why, there prevention should start while designing this kind of machines by the instauration of effective security systems or there improvement because an improved safety at such machines is already possible today [4].

Circular saw table is an essential woodworking machine, but unfortunately, during a trauma of the hand from it, lesions are often contuse, soiled, complex and multiple so that they generally require a specialized management by hand surgeons. Prevention, of course, should be the goal because of the severe functional and psychological impairments that may result from woodworking injuries.

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