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RESEARCH ARTICLE

THYROID-AXIS ALTERATIONS IN ACUTE ORGANOPHOSPHORUS POISONING AND THEIR ASSOCIATION WITH CLINICAL OUTCOMES IN THE INTENSIVE-CARE SETTING

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Abstract

Organophosphates are widely used in agricultural practice. Due to its easy availability in household, the incidence of accidental, occupational or homicidal consumptions have caused a major public health burden.OP compounds irreversibly inhibit acetyl cholinesterase, precipitating a cholinergic crisis characterized by muscarinic and nicotinic features. Serum of OP patients with non-thyroidal illness inhibits the uptake of thyroxine by hepatocytes, and prevents converting of thyroxine to triiodothyronine. Circulating factors such as cytokines probably affect thyroid hormone levels. [1] Nicotinic receptors are located in the preoptic area of the hypothalamus. It is claimed that cholinergic receptors stimulate somatostatin secretion, and somatostatin suppressed TRH and TSH secretion.[1]Previous retrospective series have reported finding-ranging from suppressed TSH with normal free hormone levels to frank thyrotoxicosis.

Introduction:-

- Organophosphates are widely used in agricultural practice. Due to its easy availability in household, the incidence of accidental, occupational or homicidal consumptions have caused a major public health burden.OP compounds irreversibly inhibit acetyl cholinesterase, precipitating a cholinergic crisis characterized by muscarinic and nicotinic features.
- Serum of OP patients with non-thyroidal illness inhibits the uptake of thyroxine by hepatocytes, and prevents converting of thyroxine to triiodothyronine. Circulating factors such as cytokines probably affect thyroid hormone levels. [1] Nicotinic receptors are located in the preoptic area of the hypothalamus. It is claimed that cholinergic receptors stimulate somatostatin secretion, and somatostatin suppressed TRH and TSH secretion.[1]Previous retrospective series have reported finding—ranging from suppressed TSH with normal free hormone levels to frank thyrotoxicosis. [1,2,3]

Objectives:-

- To quantify the incidence and pattern of thyroid dysfunction in acute Organ phosphorus poisoning patients.
- To determine the association of thyroid dysfunction with need for mechanical ventilation, Days of ICU stay and outcome in Organ phosphorus poisoning patients.
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Materials and Methods:-

- **Study design** Prospective observational study
- **S**
- **S**

Base .5 %, α 0.05, power 85 %, minimum sample = 55 (formula $N = Z^2\alpha\ S^2/d^2$).

Statistical analysis

Normality assessed via Kolmogorov–Smirnov. Continuous variables: mean ± SD, compared with unpaired t-test (unequal variances). Categorical variables: χ^2 or Fisher's exact. SPSS v26; $p < 0.05$ significant.

Inclusion criteria:

1. Adults ≥ 18 years
2. Confirmed single-compound OP ingestion
3. Written informed consent.

Exclusion criteria

1. Refusal of consent
2. Mixed/unknown compounds
3. Prior thyroid disease.

Methodology:-

Institutional Ethical Committee approval was taken. Demographic and clinical data recorded at admission. Venous blood were collected on day 3 for TSH, free T4, free T3 (chemiluminescence immunoassay; reference ranges: TSH 0.4- 4 mIU/L, FT4 0.8-1.8 ng/dL, FT3 2.3-4.2 pg/mL). Abnormal thyroid profile values were repeated at discharge.

Results:-

Thyroid Dysfunction In Op Cases

Thyroid interpretation	OP CASES
Normal	42 (76.36%)
Sub-clinical hyperthyroidism	13 (23.64%)

Thyroid-Status Interpretation Versus Intubation Requirement

		INTUBATION [YES/NO]	
		Yes[a]	No
SUB CLINICAL HYPERTHYROIDISM	Count	9	4
	%	69.2%	31.8%
NORMAL	Count	26	16

Age group with Thyroid interpretation

		Age group (years)					
		<20	20 - 30	31 -40	41 -50	>50	Total
SUB CLINICAL HYPERTHYROIDISM	Count	0	3	4	4	2	13
	%	0.0%	23%	30.7%	30.7%	15.38 %	100%
NORMAL	Count	7	10	9	6	10	42
	%	16.66%	23.8%	21.42%	14.28%	23.8%	100%
TOTAL	Count	7	13	13	10	12	55
	%	12.72%	23.63%	23.63%	18.18%	21.81%	100%

a. X2=4.34 p=.362 ns

Thyroid Dysfunction Vs Days Of Icu Stay

	<7 days	7 - 14 days	>14 days	Total
SUB CLINICAL HYPERTHYROIDISM	5 (38.46%)	8 (61.53%)	0	13(100%)
NORMAL	19(45.23%)	17(40.47%)	6(14.28%)	42(100%)
TOTAL	24	25	6	55

. X2=2.93 p=.231 ns

Outcome Vs Thyroid Dysfunction

			INTERPRETATION		
			SUB CLINICAL HYPERTHYROIDISM	NORMAL	Total
OUTCOME	Improved	Count	9	36	45
		%	69.2%	85.7%	81.8%
	DAMA	Count	2	4	6
		%	15.4%	9.5%	10.9%
	Death	Count	2	2	4
Total		Count	13	42	55
		%	100.0%	100.0%	100.0%

Among the 55 cases studied, 13(23.64%) were cases of subclinical hyperthyroidism. 49 were males and 6 were females among our study participants with male predominance among the cases(12/13). Among the study group, 12.72% were less than 20 years, 23.63% were between 21-30 years, 23.63% were between 31-40, 18.18% were between 41-50 years and 21.81% were >50 years. 84.62 %of patients of subclinical hyperthyroidism were between age group of 20-50 years and only 15.38% were above 50 years. 11 had consumed Chlorpyriphos and 2 had consumed monocrotophos among the 13 cases. 69.2% of subclinical hyperthyroidism cases required intubation , whereas 61.9% were intubated in euthyroid patients. 5 patients were admitted for <7days and 8 were admitted for 7-14 days among the cases. 69% improved, 15.4% went DAMA among the cases of subclincal hyperthyroidism and 15.4%expired whereas in euthyroid cases 85.7% improved, 9.5% went DAMA and 4.8% expired.

Discussion:-

- A sub-clinical hyperthyroid pattern was observed in 23.64% of cases in our study. A similar study by Guven M et al, found that seven (31.8%) patients had sick euthyroid syndrome. The absence of overt hyperthyroidism suggests the presence of transient central TSH suppression. It is interesting to note that Yuan D et al and Rao et al reported a case of hyperthyroidism post organ phosphorus poisoning.[2,3]
- Thyroid tissue changes in experimental rats were observed among acute op poisoning cases which appeared to be less severe with atropine therapy.[4] Huang et al observed highest risk for hypothyroidism acutely more in 1st month than later in their study indicating its relationship to toxin presence and incidence decreasing with op elimination from body.[5] Thyroid dysfunction seen in cases of op poisoning without atropine treatment questions if the tsh could be used as an indicator to check adequacy of atropinization which has scope for further studies. A study by Lerro et al[6]associates chronic op exposure to high risk of subclinical hypothyroidism in a study done among male pesticide applicators.
- Importantly, in our study thyroid status did not predict need for mechanical ventilation or days of ICU stay which is in consensus with a study by Masaud WM et al. which tells TSH has no prognostic role[7].Thyroid dysfunction in all our cases resolved at discharge which is similar to the findings by Guven M et al.[1]
- Clinically, routine thyroid testing may have limited utility in the acute management of OP poisoning, given the transient and non-prognostic nature of detected abnormalities. However, clinicians should remain vigilant for cardiovascular instability exacerbated by thyrotoxicosis in selected cases. Longitudinal follow-up could determine whether endocrine alterations persist or contribute to chronic neuropsychiatric sequelae described in OP survivors.

Conclusion:-

- In this prospective cohort of acute organ phosphorus poisoning, sub-clinical suppression of TSH was common but lacked prognostic value for ventilation ,days of ICU stay or mortality.
- Large-cohort studies are warranted to clarify the persistence and clinical significance of endocrine changes following OP exposure.

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