

The economic impact on the introduction of the antidote N-Acetyl-Cysteine in the management of the acute paracetamol intoxication in Algeria.

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Abstract

N-acetylcysteine (NAC) is the specific antidote treatment of paracetamol intoxications, which aims to prevent the complications related to them. The objective is to highlight the economic impact of using intravenous NAC versus oral NAC in the therapeutic protocol of paracetamol intoxications in Algeria. A local simulation was carried out to estimate the financial impact related to the introduction of the IV form in the Algerian market for the management of acute paracetamol poisoning (APP). An estimation of the global expenses of the management of APP cases recorded at the level of the poison control center (PCC) between 2017- 2021 with the Oral NAC according to the 72h protocol was carried out. To compare the costs of APP management using IV form during the same period and on the same patients. The results were expressed in Dollar Américain (USD). The use of NAC IV resulted in an estimated average savings of 104,47 USD per patient per incident, reducing the length of stay from 72 to 21 hours. In the end, a 20,2% reduction (153 304,73 USD vs 122 276,36 USD) in overall expenses over the last five years is estimated at 31 028,37 USD. The analysis revealed that the introduction and registration of this form could significantly reduce the expenses related to this intoxication, comparing the duration of the protocol (length of hospitalization) and the unit price of the IV form with that of the Oral form.

Introduction

Paracetamol or acetaminophen is one of the most widely sold and used analgesic and antipyretic drugs in the world. The toxicity of this molecule remains the most frequent cause of drug-induced liver failure resulting from accidental intoxication or intentional intoxication. N-acetylcysteine (NAC) is the specific antidotal treatment to paracetamol (3). It should be administered as soon as possible, preferably in the medical emergency department, in order to prevent complications related to the latter.

However, in Algeria the adequate antidote form of NAC (intravenous, oral) is not registered in the nomenclature and therefore does not have a marketing authorization despite its importance.

This study aims to answer this problem by highlighting the economic impact of the introduction of the antidote N-Acetylcysteine, in Algeria, and this, by noting the local epidemiological, clinical and economic data on its use.

Methods

Literature review: Carried out in English and French during the period from January 2022 to March 2022, on the PubMed databases and Google Scholar using keywords,

Epidemiology of Paracetamol poisoning:

A retrospective descriptive study was conducted at the PCC over a five-year period from 2017 to 2021 to identify the number of APP

Patient journey and care protocol in the hospital environment: Emergency physicians and resuscitators were identified as the key actors in the hospital management of poisoned patients, therefore a survey was conducted in different University Hospitals centers

Availability of the antidote N-Acetylcysteine in Algeria:

Hospital pharmacists at UHC Mustapha and UHC Beb El Oued were interviewed to obtain the informations,

Pharmaco-economic evaluation:

The model adopted for the local pharmaco-economic evaluation of the management of APP with (N-ACETYLCYSTEINE 200 mg granules for oral solution in sachet-dose) versus (N-ACETYLCYSTEINE 200 mg/ml injection) was inspired by JAY L. MARTELLO's study

The results were expressed in global cost of expenses by averaging the exchange rate of Algerian dinars into US dollars (USD) over the 5-year period.

Results

Between 2017-2021, the PCC has recorded 29911 cases of poisoning from all causes, of which 25571 are drug poisonings, where paracetamol presents 851 cases. The average age is 12,7 years, and a sex ratio of 0,8.

The accidental circumstance (n= 507) represented 59,6% of the cases, which 90,3% (n= 458) are children under 16 years old, N-Acetylcysteine is the antidote treatment of choice for APPs (acute paracetamol poisoning). It comes in two forms IV and oral (table 1),

Table 1: Galenic form of NAC and the protocols used.

Pays	Protocole	Forme
Algérie	Rumack 72h, une dose totale de 1330 mg/kg	Oral
France, Belgique, Royaume-Uni, Canada	Prescott 21h, une dose totale de 300 mg/kg	IV
Tunisie	Smikaton 48h, une dose totale de 980 mg/kg	IV
Maree, Arabie saoudite	Rumack, Prescott, Smikaton	IV et Oral

According to JAY L. MARTELLO's (10) study, both forms of NAC (oral and IV) were effective, so the comparison was based on the difference in the unit cost of the two forms as well as the hospital stay

The cost of care is equal to the medical cost plus the cost of hospitalization.

The total cost of the management of APP during the studied period is equal to 153 304, 73 USD.

Prestation médicale	Coût total \$
Examen biologique	32 708,34
Examen toxicologique	1 361,17
Traitement symptomatique	1 851,64
Traitement évacuateur	834,66
Antidote	9 249,76
Hospitalisation : Service d'urgence	4 6522,20
Hospitalisation : Service de réanimation	4 8520,96
TOTAL	153 304,73

Table 1: the global cost of the management of APP cases during the 5 years (2017/2021)

Comparison of the costs of management of APP using Oral NAC Versus IV NAC:

Rumack's 72-hour protocol requires a minimum three-day hospital stay, with an average of four biological tests and an average of one toxicological test. The 21-hour protocol requires a one-day hospital stay, with an average of two biological tests and one toxicological test. (Table 2) below compares the costs

Product	Unit Price (USD)	Number of units per patient	Cost of examinations (biological, toxicological) (USD)	Cost of hospitalization (USD)	Total cost per patient per incident (USD)
Oral NAC	10,4	313	108,75	98,49	234,02
IV NAC	398,2	7	73,78	32,83	129,55

Table 2: Comparison between the costs of treatment for oral NAC versus IV NAC per patient .

the unit cost of NAC (IV) is about 40 times higher than the Oral form, its use resulted in a reduction of 34,97 USD on examination costs, 65,66 USD in hospitalization costs, and 3,85 USD of treatment, per patient per incident. With the reduction in the length of stay from 72h to 21h.

As a result, the use of the IV form according to the Prescott protocol for 20 hours. Saves 104,47 USD per patient per incident (APP).

To estimate the cost that could be saved during the 5 years with the use of IV NAC according to the Prescott protocol, the same number of patients (n=297) who received oral NAC was taken as reference.

The cost to earn during the 5 years is 31028,37 USD. In the end, a reduction of 20,2% on overall expenditure over the duration of the last 5 years represents a significant budget compared to overall expenditure.

Conclusion

In addition to the advantages that the IV form of NAC has in the of APP, the analysis revealed that the introduction and registration of this form could significantly reduce the expenses related to this intoxication, in comparing the duration of the protocol (duration of hospitalization) and the unit price of the IV form with that of the Oral form,

The savings made by the introduction of the IV form of the NAC can be reinjected to improve care by making the specific assessments more available and accessible in time,

In conclusion, several recommendations can be proposed.

- First of all, it is necessary to organize awareness campaigns aimed at the general public as well as health professionals (general practitioners, emergency doctors, pediatricians and resuscitators) in order to make them aware of the abusive consumption of paracetamol and its danger, and how to recognize intoxication with the latter to avoid liver damage.
- Limiting the number of tablets per box of paracetamol to 8g and adding an alarm message.
- The implementation of instruction n°10/MSPRH/MIN of June 24, 2015, makes the declaration of poisoning compulsory.
- Make available the adequate oral form of N-acetylcysteine at the level of the central pharmacy of hospitals to facilitate management and this as a temporary solution, and the need to register the IV form of the NAC. If the latter cannot be provided by the local pharmaceutical industry, other means of obtaining it should be considered, for example signing a contract with an innovative products industry and obtaining the antidote as a donation (Access to care program), or a system allowing the import of the antidote saved elsewhere.
- Have a national updated digital database that will facilitate access to them, and will allow to know the exact number of drug poisonings and other intoxications.
- Adopt the central storage approach which is practical and economical, with the development of an online database to facilitate the communication of information on stock status and availability between health establishments.

Competing interests

The authors declare that they have no competing interests.

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