For Debate

Child Injury Intensive Monitoring System

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Summary

A system for the acquisition and recording of child injuries is described. This computer-based system is designed for implementation in three stages. Each successive stage covers wider geographical areas and provides more comprehensive facilities.

Stage 1 collects basic identification information on injured children. It provides an intensive monitoring service which alerts the agencies properly concerned with child abuse to repeated or suspicious injury cases. Misleading or suppressed information increases rather than limits the precision of diagnosis. More comprehensive details of those children thought to be at risk are collected when stage 2 is introduced. The printed results of the processing of these details are circulated to certain authorized users, and they are organized for rapid information retrieval. A central office which receives a weekly copy of this cross-referenced file provides a 24-hour information service.

In stage 3 a register containing fully structured, standardized case reports will be established. We believe that this system ensures medical confidentiality and respects the rights of parents and children.

Introduction

The incidence of child abuse is unknown. A true assessment is restricted by different definitions, failures in diagnosis, and abuse not coming to medical attention. Though conflicting estimates occur¹ it has been suggested that the yearly incidence in America is between 30,000 and 50,000 cases.² In the United Kingdom the incidence is not known. A recent study of physical injuries to children showed that 15% were misdiagnosed cases of child abuse, and a computer-based register was proposed.³ Other workers have discussed the desirability of a register and stressed the need to satisfy all aspects of medical confidentiality and protect the rights of parents and children.⁴⁻⁷ A recent report criticized communication failures and called for a pooled information system on suspected abused children.⁸

We have been developing a child injury intensive monitoring system since 1970 and present here a general outline. The system has been developed mainly to record physically abused or injured children because of their easier definition, but it is sufficiently flexible to cover the neglected or deprived child.

We believe that the efficient management of the problem must depend on a realistic and accurate assessment of its scale and nature. The system described will also enable this assessment to be made.

Description of System

STAGE 1

The principal objective is to provide a weekly computer listing of child injuries to alert the appropriate agencies to the possible occurrence of child abuse. This is sent by post to medical officers of health, general practitioners, directors of social services, and specially approved agencies.

The listings are printed under the control of computer programs, which carry out instructions such as the following:

- (a) List all new cases of injury in this area/practice.
- (b) List those cases in (a) matching those previously notified to the system, sorted into numbers of notified previous injuries—that is, those with 2, 3, 4, etc. previous injuries, subsorted on surname.
- (c) List those cases in (a) which show close but incomplete matching of all parameters.
- (d) List those cases in (a) sorted into severity indices.
- (e) List those cases in (a) sorted into indices of suspicion.
- (f) List those cases in this area/practice which will be dropped from the system at the next run because of reaching the age limit.

These listings are produced by the computer as a result of its ability to process the raw data which are entered (table I). The basic identification data are captured routinely by means of a "partial carbon proforma" which is attached to the standard hospital registration document used by the reception clerk. The proformas are coded according to the hospitals supplied. At his discretion the casualty officer may enter his assessments of suspicion and severity by ticking appropriate boxes.

The objectives will be met without great expense because the amount of computer processing time will be small. In addition no extra staff will be needed for data capture and the costs of input/output stationery will be small.

Pilot implementation will be at area or local authority level. This will permit an assessment of problems and potential conflict areas before wider expansion of stage 1.

STAGE 2

The principal objective is the production of a comprehensive file of cases which have been followed up as a result of significant information derived from the weekly listings.

This additional information is collected by a skilled interviewer. A detailed form is used to prevent the omission of essential data and to ensure standardization. Some of the descriptive features to be recorded are listed in table II. After

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TABLE I—Outline of Staged Implementation

Stage	Responsibility for Data Acquisition	Input (Acquired Data)	Outputs
1	Casualty clerk	Names Date of birth Addresses Religion, race Index of suspicion (A, B, or C) Index of severity (X, Y, or Z)	(1) Basic weekly listings (up to 4 years of age)
2	Casualty officer Social worker General practitioner Psychiatric social worker Health visitor, etc.	Ethnic groups Distinguishing features Social status Psychiatric status Marital status Other data as in table II	(1) Basic listings as above (2) Inverted files (3) Telephone reference facility
3	All agencies involved	Structured reports	As stage 2 plus standard register

TABLE II—Provisional Descriptive Features (Stage 2)

Surname
Forenames
Other surnames
Nicknames
Date of birth
Age
Addresses
School/play group/baby minder (name and address of contact individual)
Ethnic group
Hospitals involved, past and present
Local authorities, past and present (local authority departments concerned)
Agencies involved—for example, N.S.P.C.C., probation officer, or guardian (name of contact individual)
General practitioner, past and present

processing, this information leads to the production by computer of the file referred to above. This document is known technically as an "inverted file." In principle this means that the cases contained are tabulated more than once, each tabulation being sorted into order according to a different descriptive feature. Thus one tabulation would be sorted alphabetically on surname, another numerically on date of birth, and so forth.

This file design permits rapid access to cases—that is, the file can be searched rapidly and accurately to locate specific cases, including those where information may be incomplete or incorrect.

Among the specified users who receive copies of the file is a telephone reference office, which operates on a 24-hour basis. Subject to special security and confidentiality precautions casualty officers and authorized field workers are able to utilize this reference service when dealing with cases presenting in the field. This ensures prompt and effective liaison between the agencies concerned and minimizes the risk of misdiagnosis.

Other users of the inverted file will find it of value in reducing duplication of work, improving liaison and co-ordination between agencies, and ensuring that each agency plays the part for which it is best suited. In addition the inverted file will meet the outstanding need for reliable statistical information on child abuse; this in turn will lead to a realistic assessment of its scale and nature and more efficient management.

We recommend that stage 2 be implemented on a regional basis, though it has been suggested that the Greater London Area might be suitable.

STAGE 3

A register will be established and will operate on a national scale. It will consist of typed histories held at a centralized location subject to stringent security precautions and be under the control of a designated individual. The histories will be of those cases which have been followed up. The first part of each history will consist of the information contained in the inverted file. The remainder of the history will consist of paediatric, social, psychiatric, case conference, and other reports. The complete history will have a defined structure, as will its constituent reports, and the degree of standardization will enhance the value of the register as a background for research.

The system-outline diagram shows the interrelation of inputs,

Child injury intensive monitoring system.

outputs, and stored information in the fully implemented system.

Discussion

The problems of medical confidentiality and security are well known. Moreover, there is uncertainty about the legal restrictions which apply.⁷ The standard of confidentiality which has been attained in military and commercial information processing systems is far in advance of that achieved in better-regulated medical records departments. The system described here embodies legal and ethical safeguards, the technology for obtaining these having already been developed.

We propose that all new injuries to children under 4 years of age should be included in the weekly listings because, though abuse can be found at any age, in general it occurs before the age of 4.^{9 10} All cases are deleted from the weekly listings on attaining their fourth birthday, though the previous week's listing tabulates those about to be deleted. Cases presenting in the weekly listings which have led to follow-up and subsequent inclusion in the inverted file are retained in the file until their twelfth birthday. All records in the register, however, are retained indefinitely. Newly discovered cases of abuse in children between 4 and 12 years old are introduced directly into the inverted file and register.

We are well aware that child abuse is an emotive subject and that we are in a controversial field. As is usual with controversial subjects, though agencies may welcome ideas they are often reluctant to put them into use. The technical problems arising in such a system as described here are not considerable in comparison with those of a political and organizational character. It is for this reason that the necessary steering committee should consist of people occupying senior positions in the local authorities, professional fields, agencies, and technologies concerned.

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Scientific Basis of Clinical Practice

Ascites and Oedema in Liver Disease

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The mechanism of the formation of ascites and oedema in chronic liver disease is complex: in addition to redistribution of fluid there is an overall increase in the water content of the body. Though the two processes inter-relate, it is convenient to consider separately changes in the local equilibrium between the plasma and the extracellular spaces, resulting in the redistribution of fluid, and effects on renal function, resulting in overall salt and water retention by the body.

Local Equilibrium between the Plasma and the Extracellular Fluid

In the last analysis the accumulation of extracellular fluid in the tissues to form oedema and the accumulation of extracellular fluid in the peritoneal cavity to form ascites must represent a disturbance of the local equilibrium between the formation of extracellular fluid and its removal.

THE STARLING EQUILIBRIUM

In 1896 Starling¹ propounded the view that the interchange of fluid between capillaries and tissue spaces depends on the resultant of the hydrostatic and osmotic forces inside and outside the vessel. Similarly these forces acting between the extracellular fluid spaces and the peritoneal cavity determine the transfer of fluid to form ascites. Thus the resultant of the hydrostatic and osmotic gradients between the capillaries and the peritoneal cavity determine the formation or reabsorption of ascites.

There are two known physiological factors which may favour the formation of fluid within the peritoneal cavity in patients with liver disease. Firstly, hypoalbuminaemia, which is due partly to decreased synthesis of albumin by the liver and partly to an increase in the plasma volume. The low plasma albumin concentration tends to reduce the colloid osmotic force retaining fluid within the circulation, allowing leakage of fluid into the extracellular spaces as oedema and sequentially the transfer of extracellular fluid into the perito-

neal cavity to form ascites. The second factor is portal, and hepatic sinusoidal, hypertension. In chronic liver disease accumulation of fluid within the peritoneal cavity is favoured by increased intravascular pressures—firstly, in the portal venous system and hence in the splanchnic capillaries, and, secondly, in the hepatic sinusoids.

Thus there are two possible sources of ascitic fluid; the fluid may weep through the surface of the liver as a result of increased sinusoidal pressure² or may weep through the serosal surface of the intestine as a result of increased splanchnic capillary pressure.³ Fluid weeping through the surface of the liver is a sinusoidal filtrate which, because of the great permeability of the endothelial wall, has a relatively high protein concentration approximating that of plasma, as has hepatic lymph.⁴ This accounts for the relatively low protein content of ascitic fluid in patients with cirrhosis of the liver,⁵ and together with other ancillary evidence⁶ suggests that the serosal surface of the intestine is a major source of ascitic fluid in this condition.

LYMPHATIC DRAINAGE OF PERITONEUM

Counteracting the tendency to formation of ascitic fluid is the removal of fluid by the lymphatic system. Only after exhaustion of the capacity of the lymphatic system to remove fluid does ascites accumulate.⁷ An increased flow of thoracic duct lymph occurs in cirrhosis—even without ascites⁴—suggesting that increased transudation of fluid into the extracellular spaces can initially be compensated without the formation of ascites. Dilution of lymph by the carriage of excess transuded fluid presumably contributes to the observed lowering of the protein content of the lymph in patients with cirrhosis.⁸

Possibly a relative constriction at the outflow of the thoracic duct into the venous system⁹ may be a critical factor in the formation of ascites. If this were the case then cannulation of the thoracic duct, allowing easy loss of fluid from the lymphatic circulation, would cause regression of ascites. Nevertheless, recent studies have not confirmed this.¹⁰

DYNAMICS OF ASCITIC FLUID FORMATION

Ascitic fluid is not a static reservoir. Studies using radioactive water and protein show that there is a rapid flux of both substances into and out of ascitic fluid.¹¹ Nevertheless, the maximum rate of net reabsorption of ascitic fluid in the presence of portal hypertension is strictly limited and is

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