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# Using an Ishikawa diagram as a tool to assist memory and retrieval of relevant medical cases from the medical literature

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## Abstract

Studying medical cases is an effective way to enhance clinical reasoning skills and reinforce clinical knowledge. An Ishikawa diagram, also known as a cause-and-effect diagram or fishbone diagram, is often used in quality management in manufacturing industries.

In this report, an Ishikawa diagram is used to demonstrate how to relate potential causes of a major presenting problem in a clinical setting. This tool can be used by teams in problem-based learning or in self-directed learning settings.

An Ishikawa diagram annotated with references to relevant medical cases and literature can be continually updated and can assist memory and retrieval of relevant medical cases and literature. It could also be used to cultivate a lifelong learning habit in medical professionals.

## Introduction

Doctors are accustomed to learning from their more experienced peers as well as from their own experiences in treating their patients [1]. Because of this, it is important that they develop learning techniques that are proactive and encourage a lifelong learning orientation. Case reports can provide valuable sources of information for others to learn from. Studying medical cases is an effective way to enhance clinical reasoning skills and reinforce clinical knowledge [2]. A case report provides important and detailed information about a patient that is often lost in larger studies [3]. Reading case reports is also intellectually stimulating. When clinicians or medical students analyze a clinical problem, they usually start with potential common causes. For example, if a patient presents with secondary amenorrhea, a clinician will consider common causes such as pregnancy and use of contraceptive medications before exploring other less common but critical causes such as hyperprolactinemia, ovarian cancer and so on.

When clinicians are faced with a puzzling clinical problem, they may search journals that publish clinical

cases for information about the condition [4]. There are various sources for medical cases such as the *Journal of Medical Case Reports*, *BMJ Case Reports* and the *New England Journal of Medicine*. However, because of the diversity of the case reports, it may be difficult to recall and organize the located material in a systematic manner in order to explain a clinical problem. Ishikawa diagrams are an efficient way of organizing case reports in a clinical setting.

## Methods

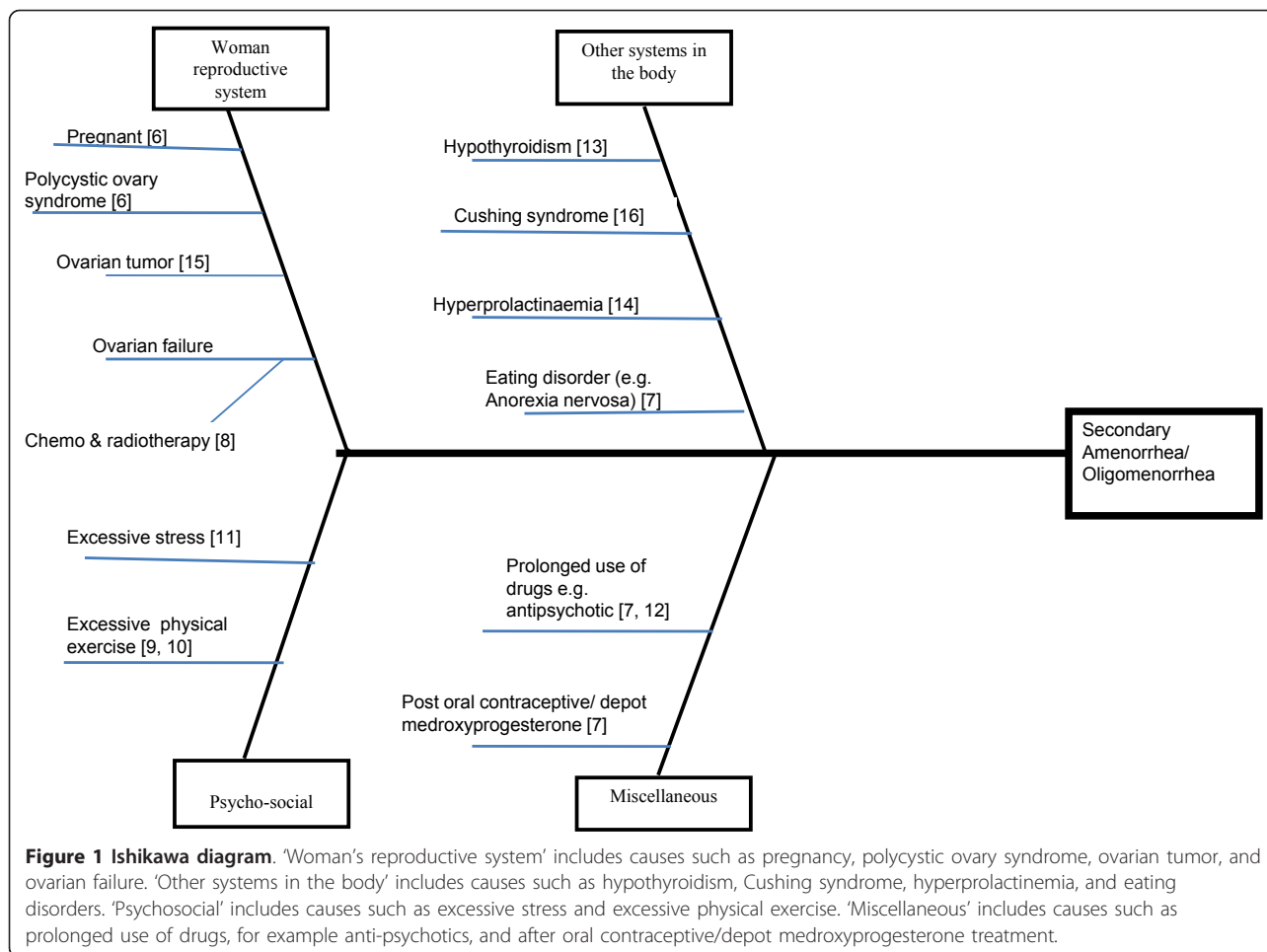
The Ishikawa diagram was invented by Kaoru Ishikawa, who pioneered quality management techniques in Japan in the 1960 s. The diagram is considered one of the seven basic tools of quality control [5]. It is also known as a fishbone diagram because of its shape. The 'fish head' represents the main problem. The potential causes of the problem, usually derived from brainstorming sessions or research, are indicated in the 'fish bones' of the diagram.

As an example for illustration, 'secondary amenorrhea/oligomenorrhea' has been chosen as the main presenting problem. 'Secondary amenorrhea/oligomenorrhea' is indicated in the head of the Ishikawa diagram (Figure 1). When searching for the potential causes of the main presenting problem, one can either work in a team with others

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or in a self-directed learning setting. Clinicians would conduct brainstorming sessions and search the relevant journals to find potential causes for secondary amenorrhea/oligomenorrhea, listing them on a whiteboard or flipchart. The list would then be reviewed to extract relevant causes in the context of the main presenting problem. These causes would then be organized in the 'fish bones' of an Ishikawa diagram (Figure 1). There is no limit to the number of 'fish bones' in the diagram. Each 'fish bone' can be subdivided into smaller 'bones' if necessary to show the relationship of all potential causes to the presenting problem. For example, 'chemotherapy and radiotherapy' are indicated in the branch of the 'fishbone' that shows the cause of ovarian failure, a potential cause for secondary amenorrhea/oligomenorrhea (Figure 1). The cited references for the relevant case reports and literatures are also indicated in the Ishikawa diagram so that readers can retrieve the case reports and relevant literatures easily.

The potential causes for secondary amenorrhea/oligomenorrhea have been identified and categorized in four groups related to 'women's reproductive systems', 'other

systems in the body', 'psychosocial', and 'miscellaneous, for example drugs'. The causes include pregnancy [6], polycystic ovarian syndrome [6], amenorrhea after oral contraceptive/depot medroxyprogesterone treatment [7], eating disorder (for example, anorexia nervosa) [7], premature ovarian failure [8], excessive physical exercise [9,10], excessive stress [11], prolonged use of anti-psychotic [7,12], hypothyroidism [13], hyperprolactinemia [14], ovarian cancer [15], and Cushing syndrome [16]. Thus the Ishikawa diagram illustrates and summarizes the potential causes for secondary amenorrhea/oligomenorrhea (Figure 1).

### Conclusions

Rare but critical cases should be studied and included in an Ishikawa diagram to remind clinicians of relevant information during their clinical reasoning processes. For example, the *Journal of Medical Case Reports* has published the case of a 22-year-old lactating woman who presented with four months of amenorrhea associated with signs of virilization. The patient was diagnosed as having an androgen secreting steroid cell

tumor of the ovary [15]. In addition, *BMJ Case Reports* has published a case demonstrating the relationship between hypothyroidism and secondary amenorrhea. Important learning points are highlighted: serum thyroid stimulating hormone (TSH) should be measured in every adolescent with menstrual irregularities, multicystic ovaries as a presenting manifestation of juvenile hypothyroidism is a rare occurrence and represents advanced disease, and appropriate diagnosis and levothyroxine replacement therapy is effective and it can prevent inadvertent surgery [13].

Furthermore, the reader should appraise the published case to assess the credibility of the information and should look for updated information in the future. For example, if the readers are not fully convinced of the explanation for the pathophysiology of 'specificity spill over' phenomenon that may contribute to multicystic ovaries [13,17], he or she should search for more information about it and look out for future publications on this topic. Information gathered from other sources can be included in the diagram as well, such as the paper published in the *British Journal of Obstetrics and Gynaecology*, which has substantiated information about ovarian cancers and amenorrhea [8]. In this way, continually organizing and updating information on an Ishikawa diagram can cultivate lifelong learning habits in medical professionals.

Medical educators can also apply Ishikawa diagrams to facilitate problem-based learning when teaching medical students and junior doctors. Starting with a clinical vignette, facilitators can help medical students and junior doctors to identify the main presenting problem of a patient, conduct brainstorming sessions and search in the literature to find the potential causes, then categorize these causes in an Ishikawa diagram. The Ishikawa diagram can then be kept by individual learners for continual updating when they acquire new or relevant information. In short, an Ishikawa diagram can assist memory and the retrieval of relevant medical case reports and literatures.

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#### Competing interests

The author declares that he has no competing interests.

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