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Original Research

Economic evaluation of an expert examiner and different ultrasound models in the diagnosis of ovarian cancer

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ADNEX model

Abstract The Risk of Malignancy Index (RMI) is commonly used to diagnose adnexal masses. The aim of the present study was to determine the cost-effectiveness of the RMI compared with subjective assessment (SA) by an expert and the following novel ultrasound models:

- Simple rules (SR) added by SA (SR + SA);
- SR with inconclusive results diagnosed as malignant (SR + Mal);
- Logistic Regression model 2 (LR2); and
- Assessment of Different NEoplasias in the adneXa (ADNEX) model.

Cost-effectiveness and budget impact analyses were performed from a societal perspective. A decision tree was constructed, and short-term costs and effects were examined in women with adnexal masses. Sensitivity, specificity and the costs of diagnostic strategies were incorporated. Incremental cost-effectiveness ratios were expressed as costs/additional percentage of correctly diagnosed patients. Probabilistic and deterministic sensitivity analyses were performed.

Effectiveness was highest for SA (90.7% [95% confidence interval = 77.3–100]), with a cost saving of 5.0% (–€398 per patient [–€1403 to 549]) compared with the RMI. The costs of SR + SA were the lowest (€7180 [6072–8436]), resulting in a cost saving of 9.0% (–€709 per patient [–€1628 to 236]) compared with the RMI, with an effectiveness of 89.6% (75.8–100).

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SR + SA showed the highest probability of being the most cost-effective when willingness-to-pay was <€350 per additional percentage of correctly diagnosed patients. The RMI had low cost-effectiveness probabilities (<3%) and was inferior to SA, SR + SA and LR2. Budget impact in the Netherlands compared with that of the RMI varied between a cost saving of €4.67 million for SR + SA and additional costs of €3.83 million when implementing ADNEX (cut-off: 10%). The results were robust when tested in sensitivity analyses.

Although SA is the best strategy in terms of diagnostic accuracy, SR + SA might be preferred from a cost-effectiveness perspective.

1. Introduction

Adnexal masses occur frequently, and although they are mostly benign, approximately 22,000 patients are diagnosed with ovarian carcinoma in the United States each year [1]. In patients diagnosed with an adnexal mass, preoperative assessment by ultrasound is valuable for determining the optimal treatment. A high diagnostic accuracy of the method used to differentiate benign from malignant adnexal masses is necessary for optimal treatment planning. Low sensitivity leads to the misclassification of malignancies. These patients undergo a laparoscopy, often followed by a second operation to achieve full staging/debulking, resulting in a higher cost. Low specificity, on the other hand, causes patients to undergo unnecessary extensive surgery with prolonged rehabilitation.

Many current guidelines endorse the Risk of Malignancy Index (RMI) to distinguish benign from malignant tumours [2]. Although the RMI is easy to use, it has low sensitivity compared with other models [3,4]. Despite the development of various scoring systems, subjective assessment (SA) by an expert ultrasound examiner remains the best method currently available [3]. However, experts are scarce and expensive. Furthermore, when patients have to pay for an extra visit to an expert for ultrasound, the costs increase for the patient and often the employer. Whether the potential cost savings associated with a higher diagnostic accuracy, and thus an increase in correct diagnoses and treatments, can offset the increase in the cost of using experts remains to be investigated.

Other methods, such as simple ultrasound-based rules (simple rules, SR), Assessment of Different NEoplasias in the adneXa (ADNEX model) and Logistic Regression model 2 (LR2) have no additional operating costs compared with the RMI and have shown a higher diagnostic accuracy [3–8].

A cost-effectiveness analysis (CEA) is of utmost importance as a pivotal step to determine whether or not to abandon the RMI and implement other methods.

The aim of the present study was to determine the short-term cost-effectiveness and budget impact of the RMI compared with SA in the diagnosis of adnexal masses. The RMI was also compared with recently introduced ultrasound models for the diagnosis of adnexal masses, including SR added by SA (SR + SA), SR with inconclusive results diagnosed as malignant (SR + Mal), LR2 and the ADNEX model.

2. Materials and methods

2.1. Scope of the economic evaluation

Short-term CEA and budget impact analysis were performed by developing a decision tree using internationally accepted guidelines [9–11]. A detailed description of the methods (based on the Consolidated Health Economic Evaluation Reporting Standards checklist) is provided in Supplementary File S1 [11].

The population consisted of women at least 18 years of age who presented to the gynaecology department of a hospital in the Netherlands in 2014 and were diagnosed with an adnexal mass requiring surgery. Epidemiologic data were obtained from the nationwide network and registry of histopathology and cytopathology in the Netherlands (PALGA, http://www.palgaopenbaredatabank.nl/), which registers pathology reports generated by all pathology departments nationwide [12]. Reports on all adnexal masses excised in 2014 (benign, borderline and malignant) were evaluated. Borderline tumours were considered to be malignant.

The time horizon of the analysis was from the time of detection of the mass until the time of recovery after the appropriate surgical intervention. Most of the consequences of misdiagnosis by ultrasound occur during this time period. Discounts for future costs were not applied because of the short time frame of less than 1 year. The analysis was performed from a societal perspective.

The costs of six diagnostic strategies were compared. These included the reference strategy (RMI) and five promising methods with high diagnostic accuracy that have the potential to replace the RMI, namely, SA, International Ovarian Tumor Analysis Group (IOTA) SR as a first step, SR + SA, SR + Mal, ADNEX and the LR2 model [5–7,13]. The ADNEX and LR2 models