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Subcutaneous trastuzumab (Herceptin) versus intravenous trastuzumab for the treatment of patients with HER2-positive breast cancer: A time, motion and cost assessment study in a lean operating day care oncology unit

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ABSTRACT

Objective: The subcutaneous (SC) formulation of trastuzumab represents an alternative to the intravenous (IV) infusion in the treatment of patients with HER2-positive metastatic and early breast cancer. We compared the two formulations in terms of time and cost differential.

Study desing: We conducted a time, motion and cost assessment study in a lean operating day care oncology unit to determine and compare the time and costs of trastuzumab SC versus IV administration in patients with HER2-positive breast cancer. Outcomes were the mean costs and the mean dedicated time of the health care professional (HCP) and patient chair time. Direct observation methodology was applied to collect data and statistical analysis was performed.

Results: The total preparation and administration time for trastuzumab IV was 4.07 times longer than the total time required for the trastuzumab SC administration. The total patient time spent in the day care oncology unit (in minutes) was 71% shorter with using SC administration. IV administration costs € 50.4 ($54,89) more in HCP time and consumable supplies and €162.53 ($177.00) of drug wastage. SC administration was associated with a total time saving of 53.7 min for the HCPs and 122.5 min for the patients. The administration of trastuzumab SC was translated in a cost saving of €212.93 ($231.73) per patient episode compared to trastuzumab IV, which could lead to a total potential saving of €3,832.74 ($4,171.06) over a full course of treatment (18 cycles)

Conclusion: SC administration of trastuzumab was associated with a substantial reduction in active HCP time, patient chair time, unit time, and overall cost. These time and cost could be used to increase capacity within existing resources in a lean operating day dare oncology unit.

Introduction

The intravenous treatment with trastuzumab (Herceptin; Roche, Basel, Switzerland) represents since a decade a gold standard in the treatment of patients with early and HER2-positive metastatic breast cancer in adjuvant setting [1–3]. The alternative subcutaneous (SC) form of trastuzumab recently introduced proved to have similar pharmacokinetic properties with the IV formulation [4]. The efficacy and safety of the SC form has been validated in the Hannah study [5].

Four studies have clearly shown significant benefits of the SC formulation when comparing to the IV formulation. First, the PrefHer study [6] was designed to evaluate the patient overall preference and the health care professionals' satisfaction regarding the route of trastuzumab administration. The results of the later study were that substituting IV infusion with SC administration of trastuzumab may lead to a substantial reduction in active HCP time, patient chair and unit time, consumable use and overall costs [6].

Alongside with the PrefHer study a small time and motion study was conducted in UK on 24 patients [7]. The study evaluated the time and cost of medical resources and the patient time spent for both SC and IV trastuzumab formulations. The results demonstrated that SC injection is associated with a significant reduction in the patient infusion chair time, almost 3 times reduction of the

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HCP time allocated to the treatment preparation and administration, and an overall cost saving estimated to €18 million for UK's National Health Service (NHS).

The Economic Institute of Iceland published results of a health economic analysis based on a micro-economic approach [8]. The total patient time spent in hospital, the duration of administration and health care costs were validated. Additionally, the benefit to the local insurance system including a productivity parameter for the patients was determined. Employed women treated with SC trastuzumab contributed more to the gross national income because they had to spent less time at the day ward unit. Calculated potential cost saving amounted to € 38,400–€ 45,000 for the 919 patient episodes included in the analysis during one year in 2012. This result can be translated in a cost saving of € 42–€ 49 per patient episode.

A fourth study conducted in 19 hospitals in Italy comparing the IV and SC therapy of trastuzumab used in patients with breast cancer along with rituximab used for the treatment of non-Hodgkin lymphoma [9]. The result showed a significant impact from a timing and cost perspectives on various aspects such as patient, medical staff and hospital administration. However, the accuracy of the study analysis might be criticized because of the survey based method used which collected information about the administration of the actual IV available therapy against the theoretically expected results of the subcutaneous therapy.

The results of these studies suggest that subcutaneous therapy could positively impact all involved stakeholders in the health care system from patient, healthcare professional, hospital and governmental perspective. The benefit from the additional time saving and cost reduction could induce an improved quality of care and cost efficiency which fits in a lean operating day care oncology unit. In fact, "Lean Oncology", is a term coined to identify a methodology of care and treatment to cancer patients, consisting on process simplification, streamlining of the organisational and routes of drug treatment, detection and elimination of waste [10]. The main objective of this way of thinking is the centrality of the patient. Thus, the successful incorporation of a simplified and timesaving clinical procedure, like trastuzumab SC administration, in a lean operating oncology unit, could give advantages yet to be locally validated.

To complete the previously published scientific proposal [11] for a non interventional prospective trial, we designed the underlying time and motion study which is similar to the previously reported UK study. The purpose is to analyse the potential time gain and cost saving for all involved stakeholders from the actual usage of trastuzumab SC therapy compared to the usage of trastuzumab IV therapy for the treatment of patients with HER2 metastatic and early breast cancer in a lean day care oncology unit.

Methods

Study design

This was an observational, non-interventional, prospective, monocentric time, motion and cost assessment study based on direct observation methodology, with application of reference costs to each observed activity. The study was conducted in the LEAN day care oncology unit of the Antwerp University Hospital. The study protocol was approved by the Ethics Committee of University Hospital of Antwerpen (reference BE300201525036).

Patients and participants

Patients treated for HER2-positive breast cancer participated to the time, motion and cost assessment study. They were informed about the study design and objectives and recruited by the HCP staff during a routine visit. Their consent was sought by a member of the HCP team, either at the first visit or at the start of a subsequent trastuzumab administration visit.

The selected HCPs participant were members of the oncology day care unit with responsibility for the management of the patients included in the study. Data was collected by direct observation of the tasks performed by the HCPs.

All participants gave a written informed consent to the presence of an observer during the administration of trastuzumab, and all completed the study period until the predefined number of measurements for both treatment formulations was achieved (65 SC and 65 IV measurements).

Data collection and management

SC injection and IV infusion data were collected of 130 patient episodes during the study period from October 6th, 2015 until November 21st, 2016. No observations for IV infusions occurring outside the study (i.e. routine clinical practice) were conducted, so that any bias was similar for both IV and SC administration. Some tasks like patient registration, lab analysis of the blood sample and oncologist visit, were expected to be equivalent for SC and IV, therefore these tasks were excluded from data collection. External

Table 1
Prespecified HCP tasks related to trastuzumab SC injection and IV-infusion preparation and administration.

All HCP tasks	
Preparation IV infusion ▯ Preparative tasks in hospital pharmacy ▯ Actual drug preparation in LAF cabinet ▯ Double check pharmacist in LAF cabinet	
Administration SC injection	Administration IV infusion
▯ Preparation of patient for SC injection (e.g. taking t°, BP and pulse)	▯ Preparation of patient for IV infusion (e.g. taking t°, BP and pulse)
▯ SC injection ▯ Remove and discard device ▯ Patient monitoring post-injection	▯ Preparation of guard IV infusion ▯ Patient monitoring during guard IV infusion ▯ Preparation of drug IV infusion ▯ Patient monitoring during drug IV infusion ▯ Preparation of saline flush ▯ Patient monitoring during saline flush ▯ Remove and discard device ▯ Patient monitoring post-infusion