METHODS

This study explored the cost consequences of introducing HAL BLFC as an adjunct to WLFC alone, for the detection and management of NMIBC recurrences in Sweden during the first year after successful initial TURBT, using a hospital perspective over a 5-year follow-up period.

Patient population

The model was populated with patients undergoing surveillance throughout regular follow-up appointments in an OP setting after being diagnosed with NMIBC and successful initial TURBT. 231 patients entered the model, based on a prevalence of 0.23% and the assumption that the population in an average-size hospital was 100,000.

Patients were stratified into risk groups: low-risk (15%), intermediate-risk (45%), and high-risk (40%).

Follow-up schedule in surveillance

The follow-up schedule for each risk group was based on Swedish guidelines:

- Low-risk: at 3 months, 12 months, and then annually for 5 years
- Intermediate-risk: at 3 months, 9 months, bi-annually for 2 years, and then annually for 5 years
- High-risk: at every 3 months for 2 years, and then bi-annually for 5 years

Treatment

The intervention arm received HAL BLFC as an adjunct to WLFC during all follow-up visits within the first year after treatment of a NMIBC recurrence, with the exception that low-risk patients did not receive HAL BLFC at their 12-month follow-up visit. Patients received WLFC alone at all follow-up visits >1 year.

All patients in the comparator arm received WLFC alone during all follow-up visits.

Model structure

The model (see Figure 1) was a combined decision-tree and Markov cohort state transition model, informed by a literature review and clinical expert opinions. The first cycle in the model was the first follow-up visit (three months after a TURBT).

A 5-year time horizon with 3-month cycles was used. Patients could experience multiple recurrences throughout the time horizon, and patient history was captured so that patients’ follow-up schedule, risk of recurrence, and risk of progression were dependent on when the most recent recurrence occurred.

Thirteen health states were used in the model (12 in NMIBC and one in MIBC). While patients remained in NMIBC surveillance, they were stratified into one of the three risk groups that in turn consisted of four detection states (true positive, false positive, true negative, and false negative). Patients who progressed to MIBC remained there for the rest of the time horizon (i.e., an all-absorbing state).

Patients could either remain in the same risk group or move to a higher risk group upon a detected recurrence. Patients in a higher-risk group could not return to a lower-risk group.

False negatives could remain undetected during subsequent follow-up visits, and because these patients received no treatment until detected, they had a higher risk of disease progression compared with true positives.

Model inputs

- The annual probabilities of recurrences and progression over 5 years were derived from a Kaplan-Meier timetable of recurrence and progression by risk group.
- The sensitivity was 94.8% for HAL BLFC and 80.4% for WLFC, based on a meta-analysis and the assumption that blue-light and white-light, flexible cystoscopy and rigid cystoscopy have relatively the same sensitivity.
- The relative predictive value (PPV) was 91.0% for HAL BLFC and 10.2% for WLFC.
- A relative risk (RR) of 0.36 was applied to patients with undetected recurrences (i.e., false negatives). The RR was applied to both the risk of changing risk group and to the risk of progressing to MIBC.
- The RR of recurrence after treatment with fulguration was incorporated in the model under the assumption that WLFC-guided fulguration had the same effect as WLFC-guided TURBT. HAL BLFC, during fulguration, reduced the risk of recurrence after one year by one third (RR=0.65 for all risk groups).
- In all patients in the low-risk group, and no patients in the high-risk group, received fulguration. For the intermediate-risk group, 40% and 35% were fulfilled for HAL BLFC and WLFC alone, respectively.
- Patients progressing to MIBC were treated with chemotherapy and followed up with CT imaging for the rest of the time horizon, according to guidelines. In addition, the risk of patients experiencing local and metastatic tumour recurrence was based on the annual risk of recurrence presented in the EAU guidelines.  

- Local tumour recurrence: 10.5% ***  
- Progressed with TURBT: 19.7% ***  
- In addition, the risk of metastatic tumour recurrence was based on the annual risk of recurrence presented in the EAU guidelines.

- Four scenarios were analysed to provide results per risk group: (Scenario 1) only low-risk patients at the model start, (Scenario 2) only intermediate-risk patients at the model start, (Scenario 3) only high-risk patients at the model start, and (Scenario 4) only high-risk patients at model start, with 18.75% of the high-risk patients receiving fulguration in OP when detected using HAL BLFC.

RESULTS

- The total costs of using HAL BLFC in addition to WLFC, compared with WLFC alone, for 231 patients in the OP setting over 5 years was SEK 14,033,864 and SEK 13,815,155, respectively. This is an estimated budget impact of 1.6% and translates to SEK 189 per patient per year. The cost was only prevalent in Year 1 and HAL BLFC in addition to WLFC was cost-saving from Year 2 onwards (Table 2).

- The cost of using HAL BLFC in addition to WLFC was attributed to the extra time needed (staff and facility) to perform flexible cystoscopies in the intervention treatment arm, whilst the cost savings came from the avoided treatment of MIBC (chemotherapy and costs after progression).

- HAL BLFC in addition to WLFC reduced resource demand versus WLFC alone (TURBT: 12.1% and 12.1%: cystoscopies: 56.3 ± 58.6; OR time (hours): 429.9 ± 447.4; bed days: 17.8 ± 19.5).

- The number of flexible cystoscopies and fulgurations was higher for HAL BLFC as an adjunct to WLFC compared to WLFC alone.

Scenario analysis

- The cost results of the scenario analysis are presented in Table 3.

Scenario 1: the total cost over 5 years was 11.9% higher for HAL BLFC in addition to WLFC compared to WLFC alone and it was not cost-saving at any point in time, although it did lead to a marginal reduction in resource use across all types of procedures.

Scenario 2: HAL BLFC in addition to WLFC led to an increase in cost over 5 years of 1.7% compared to WLFC alone but was cost-saving from Year 2 onwards. The use of HAL BLFC as an adjunct to WLFC resulted in less resource use across all types of procedures compared to WLFC alone.

Scenario 3: HAL BLFC in addition to WLFC alone resulted in a 1.2% cost increase over 5 years but was cost-saving from Year 2 onwards. Reductions in cystoscopies, OR time, and bed days were observed for HAL BLFC as an adjunct to WLFC alone, but at the same time it also led to an increase in the number of TURBAs due to the increased detection of tumours.

Scenario 4: HAL BLFC in addition to WLFC resulted in cost savings over 5 years (-3.3%) and to a reduction in OR resource use when compared to WLFC alone.

Conclusion

- The introduction of HAL BLFC in addition to WLFC results in minimal financial impact (5% total cost) over 5 years, or SEK 189 per patient per year compared with WLFC alone over 5 years, with improved patient clinical outcomes and a standard of care for Swedish health care resource use.

- The main benefit of introducing HAL BLFC was observed in high-risk patients, but it is anticipated that using HAL BLFC in all risk groups will lead to more beneficial results over the long-term.

- Patients are also likely to experience an improved quality of life with the introduction of HAL BLFC, reduced symptom burden, improved recurrence rates, and the avoidance of more invasive surgical procedures and hospitalisation burden.

- The reduction in the number of TURBAs and cystoscopies with HAL BLFC compared to WLFC alone further benefits hospitals by reducing OR time and bed days, allowing such resources to be used for other patients.

References