Cost-effectiveness of NCCN recommended chemotherapy for early stage breast cancer

Background:

Breast cancer is the most common cancer in females in the developed world. It is second leading cause of female cancer death in the United States (1). Most patients in the United States present with early stage breast cancer since the advent of mammography (2). Hence the great effort in clinical trials dedicated to finding the optimal adjuvant chemotherapy regimen to decrease recurrence and death as well as minimize toxicities related to treatment. After decades of research, the current accepted regimen includes an anthracycline, cyclophosphamide, and a taxane. The National Comprehensive Cancer Network (NCCN) has created diagnostic and treatment guidelines for most malignancies which are adopted by a majority of clinicians in decision making. Based on clinical trial data and expert opinion, the NCCN has produced a list of preferred chemotherapy regimens for early stage high risk node negative and node positive breast cancer. The preferred regimens include doxorubicin plus cyclophosphamide every 2 weeks for 4 cycles followed by paclitaxel every 2 weeks for 4 cycles (DDACT), doxorubicin plus cyclophosphamide every 2 weeks for 4 cycles followed by paclitaxel weekly for 12 cycles (DDACWKT), and docetaxel plus cyclophosphamide every 3 weeks for 4 cycles (TCx4). Other alterative regimens include docetaxel, doxorubicin, and cyclophosphamide every 3 weeks for 6 cycles (TAC) and doxorubicin and cyclophosphamide every 3 weeks for 4 cycles followed by weekly paclitaxel for 12 cycles and several other regimens (3). Many of these regimens have not been compared head to head making it difficult for clinicians to choose the best regimen for their patients. We performed a cost-effectiveness analysis of the chemotherapy regimens recommended by the NCCN to compare efficacy, quality of life, and costs amongst the regimens.

Methods:

The primary goal was to identify the most cost-effective chemotherapy regimen in the treatment of early stage breast cancer today. The primary outcome of interest is the cost per quality adjusted life years (QALY) of each regimen which allows us to quantify the gain in health compared to the cost of the intervention. To estimate our primary outcome of cost-effectiveness, we projected population consequences that extend beyond the time horizon reflected in empirical data sets. To make this extrapolation, we created a simulation model known as the Markov Model to simulate the important outcomes related to a patient with breast cancer which includes adverse events related to treatment, recurrence, death, quality of life, and costs. We created a hypothetical cohort of 500,000 patients with Her2-negative early stage breast cancer that were primarily node positive. There were 5 interventions that were simulated DDACT, DDACWKT, TC, ACWKT, and TAC with 100,000 simulations for each intervention. The efficacy of the regimens was calculating using a network meta-analysis by estimating the odds ratios of disease-free and overall survival. 7 clinical trials were included (4-10). DDACWKT was not evaluated in a clinical trial setting, therefore assumptions were made regarding its efficacy, adverse events, and cost. The population of the patients in the network meta-analysis were primarily Her2-negative, node positive, and hormone positive. Adverse events were derived from the clinical trials for each regimen. Costs of the interventions and health utility weights was derived from literature. The total costs and QALYs were calculated for each intervention over a lifetime.

Results:

The results of the network meta-analysis showed that there were no statistically significant differences in disease free or overall survival among the 4 regimens. The cost effectiveness analysis results are listed in a table below. TC was the most cost-effective regimen with lower cost and higher QALYS compared to the other regimens. TAC had the lowest QALYs and highest costs.

Intervention	QALYs	Incremental QALYs	Costs	Incremental costs
TC*	10.67	-	$ 297,882	-
DDACT	10.63	-0.04	$ 305,351	$7,469
ACWKT	10.55	-0.12	$ 305,461	$7,579
DDACWKT	10.47	-0.20	$ 307,691	$9,809
TAC	10.34	-0.33	$ 326,175	$28,292

Conclusions:

TC is a reasonable choice for patients with Her2- negative, hormone positive, node positive with 1-3 lymph nodes in an effort to decrease toxicity and improve quality of life while maintaining efficacy.

Abstracts:

Preethi K. John, Raveendhara R. Bannuru, Joshua T. Cohen, Rachel J. Buchsbaum, and John Kalil Erban. "Cost-effectiveness of adjuvant chemotherapy in early stage breast cancer." Journal of Clinical Oncology (2018) 36_suppl, e18887

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Publications:
Plan to submit network-meta analysis paper this year and cost-effectiveness analysis next year.

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