Adapted physical activity for breast cancer patients: shared considerations with two Olympic and world Italian sports champions

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Abstract. Breast cancer is a growing global public health concern. Thanks to the recent treatments progress, the survival rate of BC patients has significantly improved (88% of 5-year survival rate) and the number of cancer survivors has also increased. Notwithstanding these brilliant results, many BC patients have long-term side effects as pain, oedema, limited mobility, cancer related fatigue, etc. as a consequence of surgical, radiotherapy and medical treatments. For example, posture appears to be frequently altered after mastectomy, due to the impairment of the mobility of the arm caused by surgical scars. All these aspects negatively affect the health-related Quality of Life (QoL) of BC patients. Recent several randomized clinical trials have shown benefits of regular and appropriate physical activity (PA) during and after BC treatment, particularly in terms of benefits for health, reducing fatigue, improving strength levels, QoL and physical function. In this context, two types of sports have demonstrated their affinity and efficacy as treatment support during and after treatments for BC patients: fencing and rowing. Here we report considerations shared with two sport champions: the fencing Olympic gold medal Daniele Garozzo and the rowing World Champion Giovanni Ficarra, with the aim to find the adapted PA for BC patients.

Key Words: Breast cancer, Survivors, Lifestyle, Fencing, Rowing, Physical activity, Patients.

Introduction

Breast cancer (BC) is a growing global public health concern. During time, many different possible risk factors have been identified: besides the genetic mutations (most commonly involving BRCA1 and BRCA2) that account responsible for the hereditary form of breast and ovarian cancer, the most important risk factors for the sporadic form include personal and family history of BC, a wider fertile window (related to early menarche, older age at menopause, first pregnancy after the age of 30 and nulliparity), the exposure to external sources of hormones (during hormone replacement therapy or using oral contraceptives), dense breast tissue and lifestyle based risk factors1,2.

Despite national cancer screening programme organized since 2005, BC still affects many women in Italy. According to the recent AIRTUM report, 55,000 new cases of BC are diagnosed in our country in 2020, representing the most frequent female cancer. At the same time and due to the recent treatments progress the survival rate of patients has significantly improved (88% of 5-year survival rate) and the number of cancer survivors has also increased, passing from about 2 million in 2006 to 3.6 million in 2020 (AIRTUM – Associazione Italiana Registri Tumori)3.

The improvement of the prognosis of these patients has brought a fundamental element to the attention of health care professionals, represented by those long-term side effects, related to the disease as well as to the various necessary treatments undergone, that BC survivors have to confront4.

Surgery represents the standard treatment for loco-regional BC, while radiotherapy (RT), antistatic chemotherapy (AC), target therapy and endocrine treatment are used in adjuvant and metastatic BC setting. During the past decades, conservative surgery has become the first choice...
whenever possible, making mastectomy the preferred operation in selected cases only. Despite this, surgery still comes with multiple damaging effects, including pain, oedema, limited mobility. Posture appears to be frequently altered after mastectomy, due to the impairment of the mobility of the arm caused by surgical scars (for instance, the inner rotation and the lowering of the shoulder are common, typically causing back pain)\(^5\). In addition, lymph nodes removal is also reported as a frequent cause of limited mobility and of postoperative pain, both for the sentinel procedure and the lymph nodes axillary dissection. In addition to surgery, oncological medical treatments are also involved in numerous long-term side effects as enhancing pain, fatigue, lymphedema (after adjuvant RT treatment), peripheral neuropathy, neurocognitive dysfunction, as well as an increased risk of developing cardiovascular disease, respiratory impairments, metabolic disturbances, sexual dysfunction, compromised mental health (e.g., depression and anxiety)\(^6\)\(^\text{--}\)\(^10\), and finally, the use of aromatase inhibitor endocrine therapy has been associated with possible risk of arthralgia and bone health worsening (Table I).

All these aspects negatively affect the health-related Quality of Life (QoL) of BC survivors\(^11\)\(^,\)\(^12\).

Some randomized clinical trials\(^13\)\(^,\)\(^14\) have shown benefits of regular and appropriate physical activity (PA) during and after BC treatment, particularly in terms of benefits for health, reducing fatigue, improving strength levels, QoL and physical function. Moreover, PA has been associated with a lower risk of developing BC, with a decrease in the probability of relapse and with a higher survival rate\(^15\).

Accordingly, these non-pharmacological treatments that point to alleviate long term side effects should be rated as a public health priority, as their role is crucial in improving overall survival (OS) and QoL in BC setting, cancer survivors included. For this reason, the promotion of PA and of a healthy lifestyle (including a balanced diet and weight management) should become an everyday purpose of health care professionals\(^13\).

In this context, two types of sports have demonstrated their affinity and efficacy as treatment support during and after treatments for BC patients: Fencing and Rowing\(^16\).

In Italy various authorities, including scientific associations (LILT – Lega Italiana per la Lotta ai Tumori), sport federations and Institutions (FIS – Federazione Italiana Scherma, CONI – Comitato Olimpico Nazionale Italiano) put a particular effort in raising awareness of cancer patients and physicians to PA (adapted sports), diet and correct lifestyle, throughout the promotion of observational studies, sporting and popular events (“Nastro rosa”, “rema Roma per la vita”). We consider all these kind of interventions as an “integrative medical treatment”, able to improve the health related QoL and OS in some cancer diseases\(^17\).

### Table I. Side effects related to cancer treatments in cancer survivors.

<table>
<thead>
<tr>
<th>Late Side effects</th>
<th>Type of treatments</th>
<th>Surgery</th>
<th>Chemotherapy</th>
<th>Target Therapy</th>
<th>Endocrine therapy</th>
<th>Radiotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td></td>
<td>✓✓✓</td>
<td>✓</td>
<td>x</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>Shoulder limited mobility</td>
<td></td>
<td>✓✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>Lymphedema</td>
<td></td>
<td>✓✓</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
<td>x</td>
<td>✓✓✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Peripheral neuropathy</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Neurocognitive dysfunction</td>
<td></td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td></td>
<td>x</td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
<td>x</td>
</tr>
<tr>
<td>Metabolic disturbances</td>
<td></td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>✓✓</td>
<td>x</td>
</tr>
<tr>
<td>Arthralgia</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>✓✓✓</td>
<td>x</td>
</tr>
<tr>
<td>Depression and anxiety</td>
<td></td>
<td>✓✓</td>
<td>✓✓</td>
<td>✓</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>Bone health</td>
<td></td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>Respiratory impairment</td>
<td></td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>✓✓</td>
<td>✓</td>
</tr>
<tr>
<td>Sexual dysfunction</td>
<td></td>
<td>x</td>
<td>✓</td>
<td>x</td>
<td>✓✓</td>
<td>x</td>
</tr>
</tbody>
</table>

✓✓✓Probably related (data from RCTs); ✓✓ Might be related (data from RCTs with smaller samples); ✓Could be related (single-arm studies); xNo sufficient for side effects and cancer survivors

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In this scenario, we decided to share our oncological clinical experiences with two sport champions: the fencing Olympic gold medal Daniele Garozzo and the rowing World Champion Giovanni Ficarra, with the aim to find the adapted PA for BC patients.

Prospects are good, but further studies are still necessary to define the appropriate timing of PA (during versus after the various treatments) as well as the better type of PA in BC patients.

Fencing and Breast Cancer: Shared Considerations with Olympic Foil Champion  
Daniele Garozzo

According to Olympic medal table, fencing is Italy’s number one Olympic sport with 130 won medals. Fencing is a one-to-one competitive sport, in which the victory is possible only hitting the opponent and avoiding his counterattack. As a result, it encourages to gain (or improves if already present) the impulse to combat and win the fight. Randomized clinical trials\(^{16,17}\) have demonstrated that to begin PA after surgical treatment is able to improve the immunity function, the adherence to therapies and generally the health related QoL. In this context, recent pilot randomized controlled trials\(^{16,17}\) have demonstrated the feasibility and efficacy of fencing as PA in BC patients’ post-surgical treatment. The researchers have chosen the saber as fencing’s weapon, because it is light and allows a large range of motion (as to raise the arm over the head) of the injured side during attacks (parries and ripostes). The main objective of the study was to compare immediate vs. delayed fencing post-surgical treatment. According to scientific literature\(^ {18}\) the best window period, to start adapted fencing, is within six months from surgery treatment. The results obtained by the researchers were encouraging about: improvement of the health related QoL, the reduction of fatigue and anxiety of the patients and finally the PA modifies, positively, the metabolic profile (glycaemia and lipid value) and the immune function\(^{18}\). Furthermore, the use of fencing mask wins the shyness, and the chest protection avoids more breast trauma.

Finally, the elegance of fencing, ultimately, allows women to increase their self-esteem, usually put on the line after surgery, and encourages them to approach a little-known sport that, however, is particularly beneficial to BC survivors.

Rowing and Breast Cancer: Shared Considerations with World Rowing Champion  
Giovanni Ficarra

Rowing can be considered one of the most complete water sports, seen as though it involves the muscles of both the upper and lower limbs, of the abdomen, and almost all the body’s musculature\(^ {19}\). Another typical feature of rowing is related to the symmetrical movements performed on the boat or on the ergometer, that do not require forced positions, making this sport feasible also for people with mobility impairment. Rowing also combines strength and aerobic endurance exercises needed to stimulate heart adaptation, metabolic rate and hypertrophy, especially of slow-twitch muscle fibres\(^ {20}\). As for any other integrative approach, also in the case of PA, some researches\(^ {21}\) have demonstrated an improved health related QoL in cancer survivors, although is not always easy for patients to adhere to exercise protocols, especially in the first months after surgery or during RT and medical treatments. As a result, two out of three cancer patients do not perform the minimum levels of exercise recommended by the American College of Sports Medicine (ACSM). In this context, rowing being an outdoor team...
sport where athletes have to share the small space of a boat and work in synchrony to keep the boat in movement, promotes social relationships not only with other cancer patients, but also with other teammates and coaches\textsuperscript{22}. Several studies\textsuperscript{23,24} have already demonstrated that rowing improves the health-related QoL and physical conditions of cancer patients, favors their rehabilitation, and social integration. The best results for BC survivors have been obtained with 12-week programs combining aerobic and strength exercises. As a matter of fact, a reduction in the sequelae of the disease, especially pain, increasing the range of movement in the upper limbs, improving muscle activation, and increasing strength and muscle function, also with a strong reduction in lymphedema\textsuperscript{25,26}. Finally, all studies reported an improved health related QoL following PA interventions in BC patients, indicating that rowing training programs can be a promising tailored support therapy in this setting of patients\textsuperscript{27}.

\section*{Conclusions}

The positioning of PA and exercise for cancer patients has changed over the recent decades. Bed rest and overprotection dominated hospital wards for a long time but increasing scientific evidence from exercise studies with cancer patients demonstrated the importance of PA to reduce or even prevent disease- or treatment-related consequenc-es. Interventional prospective studies provide evidence for the efficacy of PA on patient-related outcomes like fatigue, peripheral neuropathy, lymphedema, bone health, pain, metabolic disturbances, depression and anxiety and on overall improvement of health-related QoL. There is even growing evidence for the protective effects on OS after cancer diagnosis\textsuperscript{17}. As a result, the attitude of health care professional towards PA has drastically changed, shifting from overprotection to growing enthusiasm. The efficacy of PA during cancer treatment, along with its beneficial effects on flexibility, cardiorespiratory fitness, muscle strength, body composition and health related QoL has been set out in various clinical trials (Table II)\textsuperscript{16,28-34}. In addition, many of the late complications of patient’s cancer therapy, described above (cardiovascular, musculoskeletal and respiratory impairments, metabolic disturbances, lymphedema, cancer related fatigue, etc. – Table I) have generally improved with adapted PA.

Since Oncologists play a central role in defining cancer patients’ therapeutic pathways, if they take into consideration the significance of these interventions, they will potentially play a fundamental part even in creating new healthy interventions aimed to reduce cancer burden. One of the crucial roles of oncologists and of other cancer specialists is to monitor and control short- and long-term side effects related to treatments, in order to optimize their patients’ QoL. The main intervention should consist in identifying specific risk factors of each patient (related to the type of cancer as well as to the treatment undergone) and consequently removing, whenever possible, the cause of side effects. Summarizing, the overprotecting attitude causing therapy related PA restrictions can no longer be accepted, considering that the need of exercise programs tailored to cancer patients’ possibilities, desires and preferences has widely

\begin{table}[h]
\centering
\begin{tabular}{|l|l|}
\hline
\textbf{Sport} & \textbf{Benefit} \\
\hline
Aerobic training\textsuperscript{28} & ↓CRF, ↑health-related QoL and physical function, ↓anxiety, depression, ↑sleep quality. \\
Resistance training\textsuperscript{28} & ↓CRF levels, ↑health-related QoL and physical function, ↓lymphedema, ↑aspects related to bone health. \\
Walking\textsuperscript{29} & ↓Of the BMI, ↓breast symptoms and in the arms, ↑MS at the extremity of the upper limbs, ↓of pain. \\
Fencing\textsuperscript{16} & ↑Immunity function, ↑adherence to therapies, ↑health related QoL, ↓CRF, ↓anxiety, ↑of the functional capacities. \\
Rowing\textsuperscript{30} & ↑Upper extremity and hip range of motion, ↑lower and upper extremity strength, ↑aerobic capacity and heart rate at rest and after prolonged effort. \\
Yoga\textsuperscript{11} & ↑Joint mobility, ↑muscle strength, ↑QoL. \\
Swimming\textsuperscript{32} & ↑Flexion and external rotation of the operated arm. \\
Cycling\textsuperscript{33} & ↑QoL, ↑Physical functioning, ↑general health, ↑vitality. \\
\hline
\end{tabular}
\caption{Beneficial effects of PA in cancer patients.}
\end{table}

Legend: ↓reduce; ↑improve; CRF: cancer related fatigue; QoL: quality of life; BMI: Body mass index; MS: Muscle Strength
been demonstrated. The combination of standard care and PA programs will not only reduce the incidence of the above-mentioned long-term side effects and improve psychosocial wellbeing, but also will help cancer survivors to feel normal and regain their life. We do not have to forget that PA, correct lifestyle and balanced diet are strongly recommended, by European code against cancer and they are able to reduce the cancer incidence significantly\(^5\). Moreover, future challenges about PA, will concern also another audience of patients, so called “frail patients”, as elderly, transplant and HIV-positive cancer patients\(^6\)\(^{-}\)\(^9\).

Conflict of Interests

The Authors declare that they have no conflict of interests. All authors contribute equally to drafting of this short report.

Authors’ Contribution

MB, BAF, DG, RT, GF and AB conceived the manuscript. MB, BAF, DG, GF and AB write, review and edit the manuscript. All authors approved the final version of the manuscript.

Abbreviations

AIRTUM: Associazione Italiana registro tumori; CONI: Comitato Olimpico Nazionale Italiano; FIS: Federazione Italiana Scherma; LILT: Lega Italiana per la Lotta ai Tumori.

References