European Review for Medical and Pharmacological Sciences 2022; 26: 5393-5398

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

M. BERRETTA[1,2], B.A. FACCHINI[3], D. GAROZZO[4], V. NECCI[5], R. TAIBI[6], C. TORRISI[7], G. FICARRA[7], A. BITTO[1]

[1]Department of Clinical and Experimental Medicine, University of Messina, Messina, Italy
[2]Integrative Medicine Research Group (IMRG), Noceto, Parma, Italy
[3]University of Study of Campania "L. Vanvitelli", Naples, Italy
[4] Federazione Medico Sportiva Italiana (FMSI), Rome, Italy
[5]Orthopaedics and Traumatology Unit, Tarquinia Hospital, Tarquinia (VT), Italy
[6]Gruppo Oncologico Ricercatori Italiani (GORI-ONLUS), Pordenone, Italy
[7]Department of Biomedical, Dental, Morphological and Functional Imaging Sciences, University of Messina, Messina, Italy

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 factors[1,2].

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 confront[4].

Surgery represents the standard treatment for loco-regional BC, while radiotherapy (RT), antiblastic 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

Corresponding Author: Massimiliano Berretta, MD, Ph.D; e-mail: berrettama@gmail.com

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)[4,6-10], 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[15].

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.

Late Side effects	Type of treatments				
	Surgery	Chemotherapy	Target Therapy	Endocrine therapy	Radiotherapy
Pain	✓✓✓	✓	×	×	✓✓
Shoulder limited mobility	✓✓	×	×	×	✓
Lymphedema	✓✓	×	×	×	✓
Fatigue	×	✓✓✓	✓✓	✓	✓✓
Peripheral neuropathy	✓	✓✓✓	×	×	×
Neurocognitive dysfunction	×	✓	✓	×	✓
Cardiovascular disease	×	✓✓	✓✓✓	×	✓
Metabolic disturbances	×	✓	✓	✓✓	×
Arthralgia	×	×	×	✓✓✓	×
Depression and anxiety	✓	✓✓✓	✓✓	✓	✓✓
Bone health	×	✓	×	✓✓✓	✓
Respiratory impairment	×	✓	✓	×	✓✓
Sexual disfunction	×	✓	×	✓✓	×

✓✓✓Probably related (data from RCTs); ✓✓Might be related (data from RCTs with smaller samples; ✓Could be related (single-arm studies); ×No sufficient for side effects and cancer survivors

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[15] 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 improvement of the functional capacities (shoulder) on the operated side. Moreover, the researchers concluded that adapted and secure fencing can be start in immediate post-surgery treatment. Moreover, also the foil, another fencing's weapon, is suggested within a rehabilitation Italian project, in BC patients after surgical treatment. The patients enrolled in this project are satisfied to do PA, as rehabilitation treatment, outside the hospital and together with healthy people. We can consider this kind of approach as "therapeutic fencing with adapted weapon". It is natural to ask why the fencing is a suggested sport for BC patients. The answer is intuitive and traceable to the chronic sequelae of breast surgery and RT treatments as lymphedema and morphofunctional alterations of shoulder and upper limb, which could be alleviated by fencing as an adapted sport. Lymphedema, for instance, is a problem that can occur even years after treatment, presenting as the swelling of part or of the whole limb, usually involving the arm ipsilateral to the operation. It is caused by a lack of draining by the lymph system, due to its damage during surgery (more often during lymph nodes axillary dissection) or by radiation therapy. Fencing is able to counteract these chronic sequelae and, moreover, it reduces cancer-related fatigue, improves the cardio-vascular and respiratory functions 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[22]. Several studies[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[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[27].

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 consequences. 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[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)[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

Table II. Beneficial effects of PA in cancer patients.

Sport	Benefit
Aerobic training[28]	↓CRF, ↑health-related QoL and physical function, ↓anxiety, depression, ↑sleep quality.
Resistance training[28]	↓CRF levels, ↑health-related QoL and physical function, ↓lymphedema, ↑aspects related to bone health.
Walking[29]	↓Of the BMI, ↓breast symptoms and in the arms, ↑MS at the extremity of the upper limbs, ↓of pain.
Fencing[16]	↑immunity function, ↑adherence to therapies, ↑health related QoL, ↓CRF, ↓anxiety, ↑of the functional capacities.
Rowing[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[31]	↑joint mobility, ↑muscle strength, ↑QoL.
Swimming[32]	↑Flexion and external rotation of the operated arm.
Cycling[33]	↑QoL, ↑Physical functioning, ↑general health, ↑vitality.

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[35]. Moreover, future challenges about PA, will concern also another audience of patients, so called "frail patients", as elderly, transplant and HIV-positive cancer patients[36-39].

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

1) Goodarzi E, Beiranvand R, Naemi H, Rahimi Pordanjani S, Khazaei Z. Geographical distribution incidence and mortality of breast cancer and its relationship with the Human Development Index (HDI): an ecology study in 2018. WCRJ 2020; 7: e1468.
2) Caputo R, Cianniello D, Giordano A, Piezzo M, Riemma M, Trovò M, Berretta M, De Laurentiis M. Gene Expression Assay in the Management of Early Breast Cancer. Curr Med Chem 2020; 27: 2826-2839.
3) Associazione Italiana Registri Tumori. Available at: https://www.registri-tumori.it/cms/pubblicazioni/i-numeri-del-cancro-italia-2020.
4) Tralongo P, Pescarenico MG, Surbone A, Bordonaro S, Berretta M, DI Mari A. Physical Needs of Long-term Cancer Patients. Anticancer Res 2017; 37: 4733-4746.
5) Rostkowska E, Bak M, Samborski W. Body posture in women after mastectomy and its changes as a result of rehabilitation. Adv Med Sci 2006; 51: 287-297.
6) Muzzatti B, Cattaruzza N, Piccinin M, Flaiban C, Agostinelli G, Berretta M, Annunziata MA. Cognitive function in long-term lymphoma survivors: relationship between subjective reports and objective assessments and with quality of life. Psychol Health Med 2021; 26: 968-979.
7) Giacalone A, Quitadamo D, Zanet E, Berretta M, Spina M, Tirelli U. Cancer-related fatigue in the elderly. Support Care Cancer 2013; 21: 2899-2911.
8) Muraro E, Furlan C, Avanzo M, Martorelli D, Comaro E, Rizzo A, Fae' DA, Berretta M, Militello L, Del Conte A, Spazzapan S, Dolcetti R, Trovo' M. Local High-Dose Radiotherapy Induces Systemic Immunomodulating Effects of Potential Therapeutic Relevance in Oligometastatic Breast Cancer. Front Immunol 2017; 8: 1476.
9) Yehya A, Alshari O, Alameri O, Albals D, Al-Taani G. Pre-pharmacological management: bi-screening for depression among breast cancer patients WCRJ 2022; 9: e2233.
10) Hama Y, Tate E. Survey on embarrassment of breast cancer patients receiving radiation therapy WCRJ 2020; 7: e1607.
11) Browall M, Ahlberg K, Karlsson P, Danielson E, Persson L O, Gaston-Johansson F. Health-related quality of life during adjuvant treatment for breast cancer among postmenopausal women. Eur. J. Oncol Nurs 2008; 12: 180-189.
12) Mokhatri-Hesari P, Montazeri A. Health-related quality of life in breast cancer patients: review of reviews from 2008 to 2018. Health Qual Life Outcomes 2020; 18: 338.
13) Manneville F, Rotonda C, Conroy T, Bonnetain F, Guillemin F, Omorou A Y. The impact of physical activity on fatigue and quality of life during and after adjuvant treatment for breast cancer. Cancer 2018; 124: 797-806.
14) Mishra SI, Scherer RW, Geigle PM, Berlanstein DR, Topaloglu O, Gotay CC, Snyder C. Exercise interventions on health-related quality of life for cancer survivors. Cochrane Database Syst Rev 2012; 2012: CD007566.
15) Jia T, Liu Y, Fan Y, Wang L, Jiang E. Association of Healthy Diet and Physical Activity with Breast Cancer: Lifestyle Interventions and Oncology Education. Front Public Health 2022; 10: 797794.
16) Omorou AY, Peiffert D, Rotonda C, Van Hoye A, Allado E, Hily O, Temperelli M, Chenuel B, Hornus-Dragne D, Poussel M. Adapted Fencing for Patients with Invasive Breast Cancer: The RIPOSTE Pilot Randomized Controlled Trial. Front Sports Act Living 2022; 4: 786852.
17) Lahart IM, Metsios GS, Nevill AM, Carmichael AR. Physical activity, risk of death and recurrence in breast cancer survivors: A systematic review and meta-analysis of epidemiological studies. Acta Oncol 2015; 54: 635-654.
18) Leroy M F. Fencing for promoting health after breast cancer. Rev Infirm 2017; 66: 41-43.
19) Volianitis S, Yoshiga CC, Secher NH. The physiology of rowing with perspective on training and health. Eur J Appl Physiol 2020; 120: 1943-1963.
20) Lawton TW, Cronin JB, McGuigan MR. Strength testing and training of rowers: a review. Sports Med 2011; 41: 413-432.

21) Warburton DER, Bredin SSD. Health benefits of physical activity: a systematic review of current systematic reviews. Curr Opin Cardiol 2017; 32: 541-556.
22) Ray H, Jakubec SL. Nature-based experiences and health of cancer survivors. Complement Ther Clin Pract 2014; 20: 188-192.
23) McNeely ML, Campbell KL, Courneya KS, Mackey JR. Effect of acute exercise on upper-limb volume in breast cancer survivors: a pilot study. Physiother Can 2009; 61: 244-251.
24) Asensio-García MDR, Tomás-Rodríguez MI, Palazón-Bru A, Hernández-Sánchez S, Nouni-García R, Romero-Aledo AL, Gil-Guillén VF. Effect of rowing on mobility, functionality, and quality of life in women with and without breast cancer: a 4-month intervention. Support Care Cancer 2021; 29: 2639-2644.
25) Iacorossi L, Gambalunga F, Molinaro S, De Domenico R, Giannarelli D, Fabi A. The Effectiveness of the Sport "Dragon Boat Racing" in Reducing the Risk of Lymphedema Incidence: An Observational Study. Cancer Nurs 2019; 42: 323-331.
26) Wiskemann J, Schmidt ME, Klassen O, Debus J, Ulrich CM, Potthoff K, Steindorf K. Effects of 12-week resistance training during radiotherapy in breast cancer patients. Scand J Med Sci Sports 2017; 27: 1500-1510.
27) Gavala-González J, Torres-Pérez A, Fernández-García JC. Impact of Rowing Training on Quality of Life and Physical Activity Levels in Female Breast Cancer Survivors. Int J Environ Res Public Health 2021; 18: 7188.
28) Campbell KL, Winters-Stone KM, Wiskemann J, May AM, Schwartz AL, Courneya KS, Zucker DS, Matthews CE, Ligibel JA, Gerber LH, Morris GS, Patel AV, Hue TF, Perna FM, Schmitz KH. Exercise Guidelines for Cancer Survivors: Consensus Statement from International Multidisciplinary Roundtable. Med Sci Sports Exerc 2019; 51: 2375-2390.
29) Bloomquist K, Adamsen L, Hayes SC, Lillelund C, Andersen C, Christensen KB, Oturai P, Ejlertsen B, Tuxen MK, Møller T. Heavy-load resistance exercise during chemotherapy in physically inactive breast cancer survivors at risk for lymphedema: a randomized trial. Acta Oncol 2019; 58: 1667-1675.
30) Gavala-González J, Gálvez-Fernández I, Mercadé-Melé P, Fernández-García JC. Rowing Training in Breast Cancer Survivors: A Longitudinal Study of Physical Fitness. Int J Environ Res Public Health 2020; 17: 4938.
31) Patsou ED, Alexias GD, Anagnostopoulos FG, Karamouzis MV. Effects of physical activity on depressive symptoms during breast cancer survivorship: a meta-analysis of randomised control trials. ESMO Open 2017; 2: e000271.
32) Johansson K, Hayes S, Speck RM, Schmitz KH Water based exercise for patients with chronic arm lymphedema: a randomized controlled pilot trial. Am J Phys Med Rehabil 2019; 92: 312-319.
33) McKenzie DC, Kalda AL Effect of upper extremity exercise on secondary lymphedema in breast cancer patients: a pilot study. J Clin Oncol 2003; 21: 463-466.
34) Desnoyers A, Riesco E, Fülöp T, Pavic M. Physical activity and cancer: update and literature review. Rev Med Intern 2016; 37: 399-405.
35) Karasiewicz M, Chawłowska E, Lipiak A, Więckowska B. How to Improve Cancer Prevention Knowledge? A Way to Identify Gaps and Tackle the Limited Availability of Health Education Services in Primary Health Care Using the European Code Against Cancer. Front Public Health 2022; 10: 878703.
36) Di Benedetto F, Di Sandro S, De Ruvo N, Berretta M, Masetti M, Montalti R, Ballarin R, Cocchi S, Potenza L, Luppi M, Gerunda GE. Kaposi's sarcoma after liver transplantation. J Cancer Res Clin Oncol 2008; 134: 653-658.
37) Berretta M, Lleshi A, Cappellani A, Bearz A, Spina M, Talamini R, Cacopardo B, Nunnari G, Montesarchio V, Izzi I, Lanzafame M, Nasti G, Basile F, Berretta S, Fisichella R, Schiantarelli C C, Garlassi E, Ridolfo A, Guella L, Tirelli U. Oxaliplatin based chemotherapy and concomitant highly active antiretroviral therapy in the treatment of 24 patients with colorectal cancer and HIV infection. Curr HIV Res 2010; 8: 218-222.
38) Zanet E, Berretta M, Martellotta F, Cacopardo B, Fisichella R, Tavio M, Berretta S, Tirelli U. Anal cancer: Focus on HIV-positive patients in the HAART-era. Curr HIV Res 2011; 9: 70-81.
39) Fiorica F, Cartei F, Carau B, Berretta S, Spartà D, Tirelli U, Santangelo A, Maugeri D, Luca S, Leotta C, Sorace R, Berretta M. Adjuvant radiotherapy on older and oldest elderly rectal cancer patients. Arch Gerontol Geriatr 2009; 49: 54-59.