Abstract. Aim: The aim of our study was to evaluate feasibility, reliability and cost-benefit balance of sentinel node (SN) biopsies conducted under local anaesthesia (LA) in patients affected by stage I-B or II cutaneous melanoma. Patients and Methods: A retrospective analysis was carried out in 153 patients, evaluating the number of harvested lymph nodes, perioperative and postoperative complications, operating time and operating room costs, comparing interventions under LA and general anaesthesia (GA). Operations were carried out under LA in 112 cases (73%) and under GA in the remaining 41(27%). Results: The mean number of removed SN was overall higher in the GA group but was not significantly different under LA with respect to the subgroups of axillary biopsies. No difference was noted in the number of complications. Operating time was significantly shorter under LA, with significantly lower costs. Conclusion: LA for groin and axillary SN biopsies can be a reliable and effective alternative to GA in melanoma patients, with shorter operating time, lower costs and without the side-effects and risks associated with GA.

The incidence of skin melanoma is continuously increasing in western countries for both sexes: in men more rapidly than for any other malignancy as well as in women, for which its incidence is exceeded only by lung cancer (1-2). In Italy, an annual average of 14.3 cases per 100,000 male-years and 13.6 cases per 100,000 female-years are registered (1); thus, melanoma has relevant social impact and economic consequences for the National Health System.

The presence of nodal metastasis greatly influences the prognosis of patients with cutaneous melanoma (3), and in American Joint Committee on Cancer (AJCC) stages I and II, sentinel node (SN) biopsy can be highly predictive of the status of the entire lymphatic basin (4-7). The aim of this procedure is to reach optimal staging in patients with no evidence of nodal disease, hence optimizing therapeutic chances and obtaining prolonged regional disease control with minimal morbidity (8-12).

The rise in incidence of melanoma, together with a more accurate definition of patient management, has led to a widespread increase of the number of SN biopsies carried out in western countries. This procedure is generally performed under general anaesthesia (GA), but several surgical groups have shifted from the use of GA to use of local anaesthesia (LA), because of advantages in terms of time, costs, hospitalisation period and reduction in morbidity (13, 14).

The present retrospective study aimed to demonstrate the effectiveness and reliability of SN biopsy performed under LA and whether the LA procedure actually reduces costs and morbidity in comparison with the use of GA.

Patients and Methods

Patients. SN biopsy is performed as standard procedure at the Perugia General Hospital and the Perugia University by surgeons of the Melanoma Multidisciplinary Group (P.C. and G.M.T.) according to National Comprehensive Cancer Network (NCCN) guidelines (2) and the Italian Association of Medical Oncology (AIOM) guidelines. The SN biopsy is offered to patients with malignant melanoma in AJCC stages IB and II.

Our group has been active in the field of surgical oncology since 1998, with more than 600 biopsies performed. In this study, we limited the observations to recent cases, in order to have homogeneous groups of procedures, performed by the same surgical team, in the same facilities and well after the learning curve. We retrospectively analysed data of patients operated on, from July 2008 to March 2011. In the studied period, the data of 153 out of a total of 170 patients with skin melanoma in AJCC stages IB and II who underwent SN
biopsy were recorded. We excluded 17 (10%) patients whose biopsies were conducted on more than one nodal basin under GA; according to the scintigraphic mapping, in 11 patients a bilateral axillary SN biopsy was required, in 3 a bilateral inguinal biopsy, and, in another 3 patients, an axillary and inguinal biopsy.

Operations were carried out under LA in 112 cases (73%) and under GA in the remaining 41 (27%). The choice between LA and GA was mostly based on the biopsy site: LA was chosen for all groin biopsies but three (two children and one adult patient), GA for all head and neck biopsies, while axillary biopsies were performed under LA or GA on a case-by-case basis.

Operating room costs for the LA and GA procedures were calculated.

**Biopsy technique.** The SN biopsy was conducted within 45 days from the primary tumor biopsy, commonly in a two-step procedure that involves first the excisional biopsy of the primary tumor followed by the SN biopsy, together with the re-excision of the scar (where melanoma had been removed) with wide surgical margins (2). All patients provided informed consent to the treatment based on our Institution’s approved protocol.

Preoperative lymphatic mapping was obtained by injecting 99mTc albumin (Nanocoll; Nycomed Amersham Sorin S.r.l. Saluggia, Italy) around the surgical scar. The dose was 37 MBq/ml if the operation was carried out on the same day, and 100 MBq/ml when it was scheduled the day after the scan. Approximately 1.5 ml to 2 ml were used. The radioisotope injection was followed by dynamic planar acquisition with a 128x128 matrix at 20 sec/frame for a total time of 20 min, followed by sequential static images until the SN was identified. At the end of the procedure, the nuclear medicine operator marked the SN projection on the patient’s skin to accurately direct the surgical incision. In the preoperative room, after venous cannulation, every patient underwent the injection of 0.2-0.4 ml of blue dye (Blue Patentè Violet Natrium Salz, 0.050g, Guerbet; Villepinte, France) in the skin area to be removed.

The SN was identified both with colour retrieval and with the use of an intraoperative handheld probe. The biopsy was terminated when no further radioactive spots (>10% of maximal SN emission) (15) could be identified in the operative field. The use of LA or GA did not affect the procedure progress.

LA was obtained with a blend of mepivacaine 1% and L-bupivacaine 0.5%, in equal parts; the solution was used on the monitored patient after endovenous administration of midazolam, and the total amount ranged from 10 ml to 25 ml.

All operations were conducted in a day-surgery regimen, with hospital stay ranging from 8 to 24 hours.

Harvested SNs were analyzed according to the European Organization for Research and Treatment of Cancer (EORTC) protocol (16).

**Results**

The SN biopsies were all conducted on Caucasians; the sample group consisted of 74 women (48%) and 79 men (52%), aged from 5 to 79 years (mean of 50 years, median of 56 years).

The primary tumor location was: 67 (43.7%) in the trunk, 58 (37.9%) in lower limbs, 19 (12.4%) in upper limbs and 9 (5.8%) in the head and neck region.

The procedure was performed under LA in 112 cases (73%) and under GA in the remaining 41 (27%).

The SN biopsy distribution by site was as follows: 73 inguinal biopsies (47.7% of the total), 70 of which were conducted under LA; 71 axillary biopsies (46.4%), 42 of which under LA (59.15%) and 29 under GA (40.85%); 9 head and neck biopsies (5.9%) all performed under GA.

In toto 219 sentinel nodes were removed with only one node being harvested in 99 cases (64.7%), two nodes in 44 (28.7%) and three or more nodes in the remaining 10 (6.5%).

The total number of lymph nodes harvested under GA was significantly higher than the one under LA (mean 1.63±0.73 vs. 1.36±0.61 respectively, p=0.02); but in the more homogeneous group of axillary biopsies, the number of harvested lymph nodes under GA was not significantly different from the one under LA (mean 1.83±0.75 vs. 1.6±0.79, respectively, p=0.22). The SN was diseased in 34 cases (22.2%).

As regards to morbidity, no perioperative complications were recorded, nor were there any major postoperative complications; there were 22 minor postoperative complications (14.3%), such as lymph collection and wound infection, equally distributed between the GA and LA groups.

Perioperative and postoperative related mortality was zero.

The average time elapsed between the onset of anaesthesia and the harvesting of the SN was recorded. Operating time under GA was significantly longer than under LA overall (mean 73±10 vs. 51±13 minutes, respectively, p<0.0001), as well as in the subgroup of axillary biopsies (mean 73±11 vs. 58±14 minutes, respectively, p<0.0001).

Furthermore, we calculated the global charges of the procedures, including the costs of operating room management, operating room personnel, drugs and instruments used. The postoperative charges were not considered. Mean costs with GA were significantly higher than the costs with LA (248.36±14.16 vs. 171.68±11.81 euros, respectively, p<0.0001); this finding was also confirmed in the axillary subgroup (mean 250±4.75 vs. 173.55 ±14.35 euros, respectively, p<0.0001). The costs per minute of operation did not significantly differ between the two groups: mean 3.42±0.45 vs. 3.51±0.87 euros, for LA and GA respectively (p=0.25) for patients overall and 3.45±0.42 vs. 3.15± 0.90 euros respectively (p=0.05) for the axillary subgroup.

**Discussion**

Due the frequent use of SN biopsy, some concerns have been raised regarding its cost-effectiveness (17-18); furthermore, in order to minimize risks and to obtain maximal comfort for the patient, some groups introduced local anaesthesia for SN biopsies (17, 19-20). Our group has several years of experience on SN biopsies under LA, starting in the late 1990s for inguinal biopsies and then including axillary...
biopsies. As reported by other Authors (20), SN biopsies in LA with preoperative sedation was easily performed whenever in presence of compliant patients.

We therefore analysed the cost-effectiveness of SN biopsies under both LA and GA, comparing recent data and by studying a homogeneous population, with comparable costs.

Firstly, the drugs used for LA did not cause remarkable side-effects in our experience, validating the reliability of the procedure. The amount of used local anaesthetic was always less than the recommended maximal safe dose, and patients tolerated the procedure well, with neither signs of local nor general toxicity, as also previously reported by other surgical groups (17). Furthermore the lasting effect of local anaesthetics often assured the patient a painless postoperative period (20).

The LA reliability was also demonstrated by comparing the number of nodes removed in each group. As a matter of fact, if the number of harvested lymph nodes in the global group of patients is considered, it appeared to be higher when the procedure was performed under GA, but this result combines biopsies conducted in different basins: it is well known, for example, that a higher number of SN are biopsied when primary lesions are axial (head and neck or trunk) compared with those of the extremities (21) and all the head and neck biopsies, here, were performed under GA. In fact, when analysing the more homogeneous group of axillary biopsies, the number of lymph nodes harvested under GA was not significantly different from the one under LA (mean 1.83±0.75 vs. 1.6±0.79, respectively, p=0.22). These results are in line with those previously reported on the subject by other Authors (17).

As a second step, we compared the operating time between the LA and GA groups, considering the average time elapsed between the onset of anaesthesia and the SN harvesting. The operating time was shorter under LA than under GA (51±13 and 73±10 minutes respectively, p<0.0001) in patients overall. But separately considering the axillary biopsies, the group mostly shared between the LA and GA groups, the difference was slightly inferior, 58±14 vs. 73±11 minutes for LA and GA, respectively, even if it remained statistically significant (p<0.0001). Again our results are congruous with previous reports (17).

We must also stress the favourable point that the general occupancy of operating rooms is shorter when LA is used.

A possible explanation for the shorter operating times for LA is the absence of the dead times that every surgeon commonly experiences between the onset of GA and the skin incision; in contrast, when the procedure was performed under LA, anaesthetics were administered right after patient positioning on the operating table, and then we prepared the operating field during the time required for the drugs to take effect. Other studies partly explain the times reduction with the reduced blood circulation in the anaesthetized area due to adrenalin-adjuvated drugs injection, that could facilitate the SN location and harvesting (17, 20). Nevertheless in our experience adrenalin-adjuvated anaesthetics were never used; thus the blood circulation in the operating field was the same no matter what kind of anaesthesia was used and it could not be advocated as a reason for shortening operating times.

As far as the economic viewpoint is concerned, we calculated the global costs of both procedures, including the costs of the operating room management, personnel, drugs and instruments used, without considering the postoperative expenses. Our results showed an average expense of 171.68 euros and 248.36 euros for each LA and GA procedure respectively, significantly in favour of the former one (p<0.0001); similar results also arose from the analysis of the axillary subgroup (mean 173.55 vs. 250, p<0.0001). Other reports first demonstrated costs difference in favour of LA procedures, with results even more impressing than ours (17); the difference between those and our costs is basically due to the fact that in our centre we always used the same premises and staff, independantly of the kind of anaesthesia we used.

Another reported advantage in favour of LA is in avoiding the common side-effects of GA, whether general (nausea, vomiting, etc.) or those related to tracheal intubation (17, 20); we could also notice these advantages and, as far as morbidity and mortality are concerned, we had no procedure related mortality, nor perioperative, neither major postoperative complications. We only noticed minor postoperative problems that occurred in 14.3% of all patients, that is similar to previous published results (20); lymph collection and wound infection were equally distributed between the GA and LA groups.

Furthermore, a patient operated under LA can easily and safely be repositioned during the procedure, as is often required when the primary tumour site and the SN biopsy area are not adjacent and cannot be reached at the same time; this is the rule, for example, in every case of dorsal trunk-located primary tumour.

**Conclusion**

Our study demonstrates that LA for SN biopsy in melanoma patients can be a reliable alternative to GA, at least in procedures conducted for groin and axillary regions.

The operation under LA retains its effectiveness, sparing the patient the side-effects of GA, with a relevant reduction of costs and operating times.

**Conflicts of Interest and Source of Funding**

None declared.
References


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