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Boost by Brachytherapy in Breast Cancer: Experience of the Radiotherapy Department at CHU Hassan II of Fès

Meme Kanserinde Brakiterapiyle Destek: Fès CHU Hassan II Radyoterapi Bölümü Deneyimi

Chrifi Alaoui Ghita[1], Hassani Wissal[1]

[1]Radıotherapy Department, CHU Hassan II Fes, Morocco

ABSTRACT

Introduction: Breast-conserving surgery combined with external beam radiotherapy (EBRT) is widely recognized as an effective treatment for localized breast cancer. To improve local control, a boost dose to the tumor bed is frequently recommended, particularly for patients at higher risk of recurrence. High-dose-rate (HDR) interstitial brachytherapy enables precise boost delivery while reducing radiation exposure to surrounding healthy tissues.
Objective: To evaluate the efficacy and safety of HDR interstitial brachytherapy as a boost following EBRT in patients with T1-T2 breast cancer.
Method: This retrospective study included 21 patients with T1-T2 breast cancer treated at the Radiotherapy Department of CHU Hassan II of Fez from October 2016 to December 2023. Patients underwent lumpectomy and were selected based on GEC-ESTRO and ASTRO inclusion criteria. Initial EBRT was delivered via conventional fractionation (50 Gray in 25 fractions) or hypofractionation (42 Gray in 15 fractions), followed by an HDR brachytherapy boost of 8-10 Gray administered in two fractions with a minimum 6-hour interval. Clinical and radiological follow-ups were conducted to assess local control, side effects, and survival.
Results: The median age was 44 years, with a median follow-up of 55 months. Among the 21 patients, 11 presented with T1 stage cancer, and 10 with T2 stage. The local recurrence rate was 4.76%. Mean disease-free survival was 54.4 months, and overall survival was 56 months. HDR brachytherapy showed strong local control, with minimal recurrence rates and favorable survival outcomes.
Conclusion: HDR interstitial brachytherapy as a boost following EBRT in breast-conserving surgery appears to be an effective approach for enhancing local control in T1-T2 breast cancer, with low recurrence and good survival outcomes. These findings support HDR brachytherapy as a viable, tissue-sparing option for boosting tumor bed dose in this patient group.

Keyswords: Breast-Conserving Surgery, High-Dose-Rate Brachytherapy, External Beam Radiotherapy, Breast Cancer, Local Control, Survival.

ÖZET

Giriş Meme koruyucu cerrahi ile birlikte eksternal ışın radyoterapisi (EBRT), lokalize meme kanseri için etkili bir tedavi olarak kabul edilmektedir. Lokal kontrolü iyileştirmek için, özellikle nüks riski yüksek olan hastalarda, tümör yatağına bir boost dozu sıklıkla önerilmektedir. Yüksek doz oranlı (HDR) interstisyel brakiterapi, çevredeki sağlıklı dokulara radyasyon maruziyetini azaltırken hassas destek dozunun verilmesini sağlar.
Amaç: T1-T2 meme kanserli hastalarda EBRT sonrası boost olarak HDR interstisyel brakiterapinin etkinliğini ve güvenliğini değerlendirmek amaçlanmıştır.
Yöntem: Bu retrospektif çalışmaya Ekim 2016-Aralık 2023 tarihleri arasında Fez CHU Hassan II Radyoterapi Bölümünde tedavi edilen T1-T2 meme kanserli 21 hasta dahil edilmiştir. Hastalara lumpektomi uygulandı ve GEC-ESTRO ve ASTRO dahil etme kriterlerine göre seçildi. İlk EBRT, konvansiyonel fraksiyonlama (25 fraksiyonda 50 Gray) veya hipofraksiyonlama (15 fraksiyonda 42 Gray) yoluyla uygulandı ve ardından minimum 6 saat arayla iki fraksiyonda uygulanan 8-10 Gray'lik bir HDR brakiterapi desteği verildi. Lokal kontrol, yan etkiler ve sağkalımı değerlendirmek için klinik ve radyolojik takipler yapıldı.
Bulgular: Ortalama yaş 44, ortalama takip süresi 55 aydı. Toplam 21 hastanın 11'i T1 evre, 10'u T2 evre kanserdi. Lokal nüks oranı %4.76 idi. Ortalama hastalıksız sağkalım 54.4 ay ve genel sağkalım 56 aydı. HDR brakiterapi, minimal nüks oranları ve olumlu sağkalım sonuçları ile güçlü lokal kontrol gösterdi.
Sonuç: Meme koruyucu cerrahide EBRT'yi takiben destek olarak HDR interstisyel brakiterapi, düşük nüks ve iyi sağkalım sonuçları ile T1-T2 meme kanserinde lokal kontrolü arttırmak için etkili bir yaklaşım gibi görünmektedir. Bu bulgular, HDR brakiterapinin bu hasta grubunda tümör yatağı dozunu artırmak için uygulanabilir, doku koruyucu bir seçenek olduğunu desteklemektedir.

Anahtar Kelimeler: Meme Koruyucu Cerrahi, Yüksek Doz Hızında Brakiterapi, Eksternal Işın Radyoterapisi, Meme Kanseri, Lokal Kontrol, Sağkalım.

Corresponding Author: Chrifi Alaoui Ghita, e-mail: ghitalalaouichrifi@gmail.com
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INTRODUCTION

Breast-conserving surgery, combined with external beam radiotherapy (EBRT), is a standard treatment for localized breast cancer. To optimize local control, an additional boost dose is often administered to the tumor bed following EBRT, particularly in patients at high risk of recurrence. Among the techniques used to deliver this boost, high-dose-rate (HDR) interstitial brachytherapy stands out for its ability to precisely target the area at risk while minimizing exposure to adjacent healthy tissues. Introduced at the Radiotherapy Department of CHU Hassan II of Fès in 2016, this technique is the subject of our retrospective analysis, where we detail the methodological, epidemiological, and prognostic aspects of our practice.

METHODS

Between October 2016 and December 2023, 21 patients with localized breast cancer (stage T1-T2) received initial external beam radiotherapy followed by HDR interstitial brachytherapy at the Radiotherapy Department of CHU Hassan II of Fès. The inclusion criteria followed the GEC ESTRO and ASTRO recommendations, with the exception of age (over 60 years), and included patients who had undergone lumpectomy with negative surgical margins and for whom a boost dose was indicated due to specific risk factors.

• Initial treatment: External beam radiotherapy (EBRT) to the entire breast, either in conventional fractionation (50 Gy in 25 fractions) or hypofractionation (42 Gy in 15 fractions).

• HDR interstitial brachytherapy boost: Delivered in 2 fractions, with a total dose of 8 to 10 Gy administered to the tumor bed, with a minimum interval of 6 hours between the two fractions. Figure 1.

Patients were rigorously followed up, including regular clinical and radiological assessments, to monitor local recurrences, side effects, and survival outcomes. Figure 2

RESULTS

The median age of the patients was 44 years, with a median follow-up of 55 months. Among the 22 cases studied, 11 patients had stage T1 cancer and 10 had stage T2 cancer. The observed local recurrence rate was 4.76%. The mean disease-free survival was 54.4 months, while the mean overall survival was 56 months. These results highlight good therapeutic efficacy, with a low local recurrence rate and favorable survival outcomes over the follow-up period.

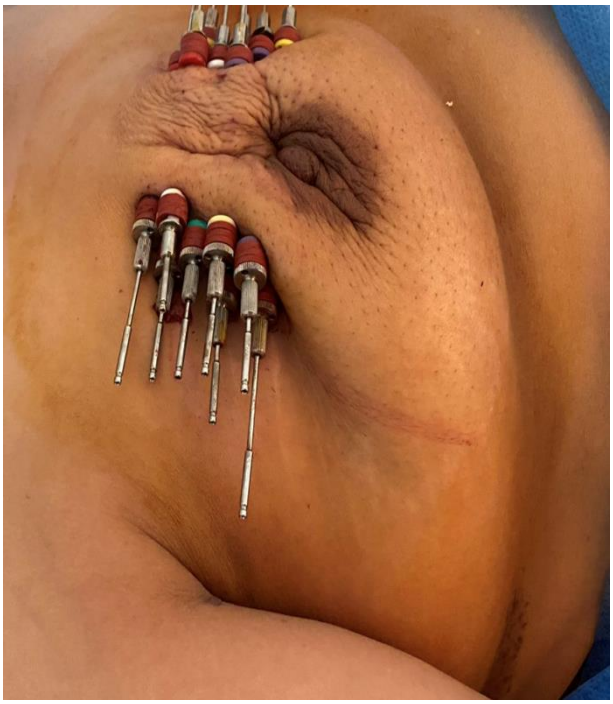
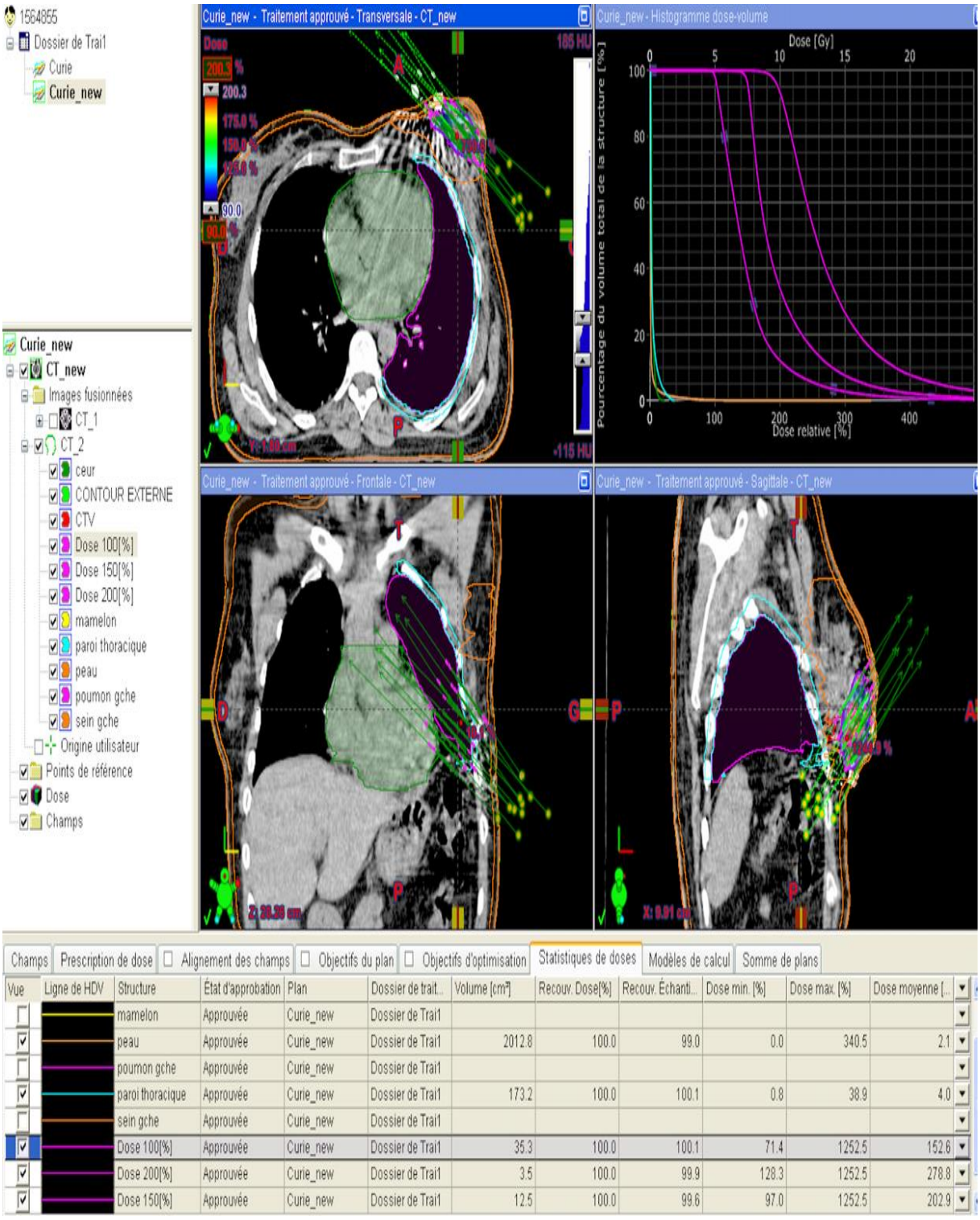


Figure 1. Image showing the placement of brachytherapy applicators on of the patients



Vue	Ligne de HDV	Structure	État d'approbation	Plan	Dossier de trait...	Volume [cm³]	Recouv. Dose[%]	Recouv. Échanti...	Dose min. [%]	Dose max. [%]	Dose moyenne [...
☐		mamelon	Approuvée	Curie_new	Dossier de Trai1						
☑		peau	Approuvée	Curie_new	Dossier de Trai1	2012.8	100.0	99.0	0.0	340.5	2.1
☐		poumon gche	Approuvée	Curie_new	Dossier de Trai1						
☑		paroi thoracique	Approuvée	Curie_new	Dossier de Trai1	173.2	100.0	100.1	0.8	38.9	4.0
☐		sein gche	Approuvée	Curie_new	Dossier de Trai1						
☑		Dose 100[%]	Approuvée	Curie_new	Dossier de Trai1	35.3	100.0	100.1	71.4	1252.5	152.6
☑		Dose 200[%]	Approuvée	Curie_new	Dossier de Trai1	3.5	100.0	99.9	128.3	1252.5	278.8
☑		Dose 150[%]	Approuvée	Curie_new	Dossier de Trai1	12.5	100.0	99.6	97.0	1252.5	202.9

Figure 2. Dosimetry image of HDR interstitial brachytherapy for tumor boost in breast cancer in one of the patients

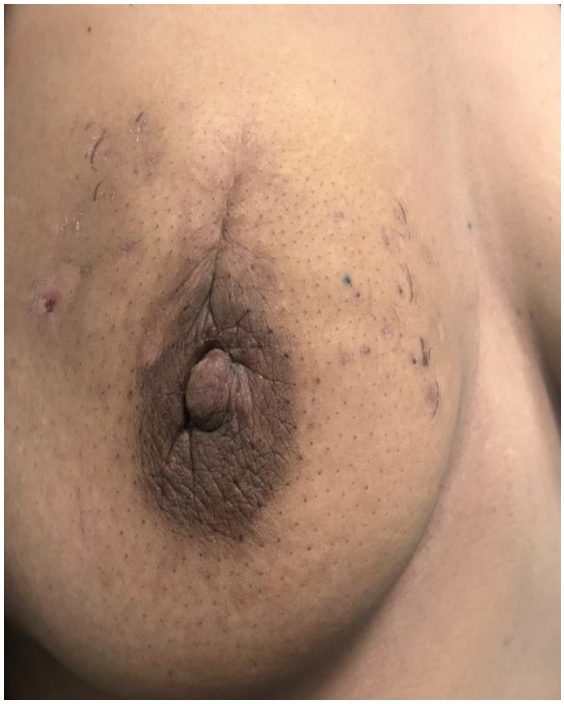


Figure 3. Image showing the esthetic result of the brachytherapy on of the patients

DISCUSSION

The use of brachytherapy as a boost in breast cancer treatment has gained recognition for its potential to deliver high doses of radiation directly to the tumor bed with precise localization. This technique is particularly relevant in breast-conserving therapy (BCT), where achieving local tumor control while preserving breast aesthetics is critical. Recent studies emphasize the role of brachytherapy in improving local control in breast cancer patients. A meta-analysis by Polgár et al. reinforced that a radiation boost, particularly with brachytherapy, significantly reduces local recurrence rates in patients receiving whole-breast irradiation (WBI) compared to WBI alone. The highly conformal nature of brachytherapy allows for the delivery of higher radiation doses directly to the tumor bed, while minimizing radiation exposure to adjacent healthy tissues. This finding is especially important for younger patients and those with close or positive surgical margins, who are at higher risk for local recurrence (1,6).

In our experience at the Radiotherapy Department of CHU Hassan II in Fez, where we introduced high-dose-rate (HDR) interstitial brachytherapy in 2016, our results align with these findings. Over a median follow-up of 55 months, we observed a local recurrence rate of only 4.76%, demonstrating the efficacy of this approach in maintaining local control. Our cohort, with a median age of 44 years, included patients at higher risk of recurrence due to factors such as younger age, stage T2 disease, and specific risk factors necessitating a boost. This highlights the effectiveness of brachytherapy in targeting high-risk populations, particularly younger patients and those with more aggressive disease profiles.

Cosmetic outcomes and toxicity are other critical considerations when comparing brachytherapy to external beam radiation therapy (EBRT). Cosmetic deformities, including fibrosis and skin changes, have been a concern with EBRT boosts, where higher doses can affect surrounding healthy tissues. A randomized trial by Major et al. showed that brachytherapy, particularly with interstitial techniques like the one we employed, offers superior cosmetic outcomes and significantly lower rates of fibrosis compared to EBRT (2). In our practice, we noted satisfactory cosmetic outcomes, with no major adverse effects observed over the follow-up period. The steep dose gradient achievable with HDR brachytherapy allows us to limit radiation exposure to surrounding tissues, such as the skin, fat, and chest wall, while still delivering a potent dose to the tumor bed.

Patient selection is critical for determining the appropriateness of a brachytherapy boost, and our selection criteria mirrored international guidelines, focusing on high-risk features such as lymphovascular invasion and close margins. Our results demonstrate that HDR interstitial

brachytherapy offers a significant therapeutic advantage, especially in younger patients who are at greater risk for local recurrence. This is consistent with the literature, where brachytherapy has proven particularly beneficial in reducing recurrence in younger women (3).

Comparative studies reinforce the advantages of brachytherapy over EBRT, particularly in terms of toxicity and cosmetic outcomes (4). In our practice, we also observed reduced acute and late toxicities, further supporting the preference for brachytherapy as a boost option in selected patients. While EBRT remains a viable option, brachytherapy's precision in targeting the tumor bed and minimizing damage to surrounding tissues makes it an appealing choice, especially for high-risk early-stage breast cancer patients.

However, despite its benefits, brachytherapy is not without limitations. The need for specialized equipment and technical expertise restricts its widespread use. At our center, the introduction of HDR brachytherapy required significant investment in both training and equipment. Newer techniques, such as intraoperative radiation therapy (IORT), may simplify the process and offer single-session boosts during surgery. The TARGIT-A trial has shown that IORT can be a feasible alternative in select cases, although we have yet to adopt this approach at our institution (5).

As brachytherapy continues to evolve, ongoing research is focusing on improving techniques, optimizing patient selection, and assessing long-term outcomes. In our own practice, continued follow-up and future studies will help refine our understanding of the long-term efficacy and safety of HDR brachytherapy in breast cancer. Advances in image-guided brachytherapy and comparative studies on quality of life, cost-effectiveness, and cosmetic outcomes between brachytherapy and EBRT will be crucial in guiding future clinical decisions.

CONCLUSION

In conclusion, our experience at CHU Hassan II in Fez demonstrates that HDR interstitial brachytherapy is an effective boost technique in breast-conserving therapy, offering good local control, low recurrence rates, and favorable cosmetic outcomes. While technical expertise and equipment are necessary, the initial results from our practice are promising and support the continued use of brachytherapy in selected patients. Further research and long-term studies will help optimize outcomes and ensure the best care for patients with early-stage breast cancer.

DESCRIPTIONS

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No conflict of interest.

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