At-Home HSCT

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63.1 Autologous HSCT

63.1.1 Introduction

Toxicity and mortality associated with auto-HSCT have been reduced, and outpatient parenteral antimicrobial treatment has been proven feasible and safe, thanks to modern CVC and infusion devices. These advances have led to the development of outpatient auto-HSCT programs, and several studies have demonstrated their feasibility and safety.

There are various reasons for transferring the support of the neutropenic phase of auto-HSCT to the ambulatory setting, including patient preference, reduced exposure to hospital microorganisms, better use of hospital resources, and cost-saving issues (Meisenberg et al. 1997). In this model, however, patients experience time-consuming daily travel to the outpatient clinic for blood tests and physician checkups. "Hospital at home" is an alternative, designed to reduce hospital outpatient admissions by providing hospital equivalent care to patients in the home setting (Westermann et al. 1999; Fernández Avilés et al. 2006).

63.1.2 Ambulatory Auto-HSCT Models

Complete outpatient program (Holbro et al. 2013)	
Conditioning regimen, HPC and management of the aplastic phase	Outpatient clinics
Delayed admission (Anastasia et al. 2009)	
Conditioning regimen and HPC infusion	Inpatient
Management of the aplastic phase	Early discharge (+1) and readmission (+5)
Mixed inpatient-outpatient (Morabito et al. 2002)	
Conditioning regimen	Outpatient clinics
HPC infusion	Inpatient
Management of the aplastic phase	Outpatient clinics
Early discharge outpatient (Martino et al. 2014)	
Conditioning regimen and HPC infusion	Inpatient
Management of the aplastic phase	Outpatient clinics
Early discharge at home (Fernández Avilés et al. 2006)	
Conditioning regimen and HPC infusion	Inpatient
Management of the aplastic phase	At home

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63.1.3 Inclusion Criteria for Ambulatory Auto-HSCT

Patient	– Age ≤65 years – ECOG ≤2 – Normal cardiac, lung, liver, and renal function – Recent documented infection with a proven secondary prophylaxis – Absence of refractoriness to platelet transfusion – Signed written informed consent
Transplant Center	– Outpatient clinics available 24 h per day or bed reserved in the transplant unit – Dedicated phone line 24h × 365 days to allow patients or their caregivers to contact an expert physician of the transplant team
Disease	– CR or PR before the auto-HSCT – No symptomatic advanced disease
Caregiver	Availability of a suitable caregiver 24 h per day, 7 days a week
Home	– Clean house – Travel time from home to the hospital less than 60 min at rush hours

63.1.4 General Recommendations for At-Home Auto-HSCT

Dose of CD34+ cells, use of G-CSF after HPC infusion, primary antimicrobial prophylaxis, and supportive care (hydration, management of emesis and metabolic disorders, analgesic therapy, and transfusion of blood products) should not differ from that recommended for conventional auto-HSCT. All these treatments can routinely be performed at home or in outpatient clinic.

63.1.5 Most Frequent Reasons for Readmission (Ordered by Frequency)

Persistent fever >38 °C without identified infectious focus

Severe oral mucositis or gastrointestinal toxicity (WHO grade III or IV) with insufficient liquid intake

Severe sepsis with organic failure

Request of the patient (psychological distress) or loss of caregiver support

63.1.6 Treatment of Fever in At-Home Setting

If fever occurs, the patient should be evaluated quickly by an expert hematologist on call. The use of empiric antibacterial treatment should follow guidelines/recommendations for patients with hematologic malignancies and neutropenic fever. IV antibiotics should be preferred and chosen in the light of clinical and laboratory findings. After at least 6 h monitoring, hemodynamically stable patients without relevant clinical problems may be followed at home. Table 63.1 shows the different empiric antibiotic therapy that could be used at home.

63.1.7 Incidence of Readmission in Outpatient and At-Home Auto-HSCT

The incidence of readmissions is closely related to the experience of the group of professionals in outpatient or at-home management of complications and by the support infrastructure available in the hospital.

Table 63.1 Empirical antibiotic therapy

Patients not receiving prophylaxis with quinolones
Levofloxacin (PO or IV) Moxifloxacin PO Ciprofloxacin PO associated or not to amoxicillin/clavulanate Ciprofloxacin PO associated or not to linezolid PO
Patients receiving prophylaxis with quinolones
IV ceftriaxone or piperacillin/tazobactam[a] or meropenem[b] associated to teicoplanin IV[c] if intense oral mucositis If there is a high suspicion of CVC infection, add teicoplanin and an anti-GNB such as amikacin IV and evaluate the CVC withdrawal If allergic to beta-lactam: quinolones PO/IV associated with teicoplanin IV and amikacin IV

[a]Stable at room temperature so it can be administered at home by electronic intermittent infusion pump

[b]Accurate refrigeration to achieve adequate stability for home administration

[c]The first option at home would be teicoplanin once daily instead of vancomycin IV (twice a day). Other alternatives rarely necessary in the context of auto-HSCT are daptomycin IV or linezolid PO

In patients with *MM*, usually conditioned with MEL, the lowest readmission rates have been reported (between 10 and 20%) due to the low organic toxicity (Martino et al. 2016). They are clearly the best option when considering starting an outpatient or at-home auto-HSCT program.

In patients with *NHL or HL* usually conditioned with a more toxic regime (BEAM or BEAC), there is a significantly higher readmission rate, between 30 and 90%, according to the series (Faucher et al. 2012; Scortechini et al. 2014).

In the *hospital clinic* at-home auto-HSCT experience, the low rate of febrile neutropenia is achieved, thanks to the intensification of antibiotic prophylaxis (ceftriaxone in MM and piperacillin/tazobactam in NHL and LH patients), and the successful control of fever at home resulted in an overall readmission rate significantly lower (8.5%) in a series of 325 patients.

63.1.8 Quality of Life

The data published are limited and contradictory. Thus, (Summers et al. 2000) reported significantly higher scores for emotional well-being and global QOL in outpatients, while (Martino et al. 2018) indicated that the outpatient model neither improves nor impairs global patient QOL on the first 30 days after auto-HSCT. In this sense (Schulmeister et al. 2005) reported that the QOL decreased immediately post treatment but then increased to above pretreatment levels by 6 months. A good clinical outcome following auto-HSCT was associated with better QOL and greater satisfaction with care.

63.1.9 Cost Data

The study of "real" costs of these ambulatory/domiciliary auto-HSCT programs is still to be carried out. In the absence of well-designed studies aimed at evaluating the "real" savings achieved with outpatient/at-home auto-HSCT programs, some authors cite direct savings between 10% and 50% (Meisenberg et al. 1998; Fernández Avilés et al. 2006; Holbro et al. 2013), especially influenced by the release of hospital beds and low readmission rates.

63.2 Allogeneic HSCT

63.2.1 Introduction

The consolidation of ambulatory auto-HSCT modalities as a safe and potentially cost-saving procedure and the introduction of NMA and RIC conditioning chemotherapies minimizing toxicity have allowed the development of allo-HSCT ambulatory programs. Indeed, the main relevant results with this type of modality have shown a safe profile in terms of lower rate of infection and GVHD improving QOL, conditions that should expand the development of ambulatory modalities into the allo-HSCT setting (Svahn et al. 2002). However, after two decades of the first ambulatory allo-HSCT program, the experience with this modality is limited to few BMT groups.

63.2.2 Ambulatory Allo-HSCT Models

Complete outpatient program (McDiarmid et al. 2010)	
Conditioning regimen and HPC infusion	Outpatient clinics
Management of the aplastic phase	
Mixed inpatient-outpatient (Solomon et al. 2010)	
Conditioning regimen	Outpatient clinic
HPC infusion	Inpatient
Management of the aplastic phase	Outpatient clinic
Early discharge at home (Ringdén et al. 2018)	
Conditioning regimen and HPC infusion	Inpatient
Management of the aplastic phase	At home

63.2.3 Inclusion Criteria for At-Home Allo-HSCT Patients

Inclusion criteria for at-home allo-HSCT patients: Specifically, apply similar conditions as an at-home auto-HSCT.

63.2.4 General Recommendations for At-Home Allo-HSCT

Apply whole hints described for auto-HSCT. Moreover, strictly frequent dosage of IS (2–3 times per week) is recommended. Monitoring of CMV and *Aspergillus* should not differ from that recommended for conventional allo-HSCT. Primary prophylaxis for *Aspergillus* is not established but is strongly suggested.

63.2.5 Which Readmission Criteria?

Which readmission criteria? Apply similar conditions for ambulatory auto-HSCT plus evidence of GVHD grades II–IV.

63.2.6 Treatment of Fever in At-Home Setting

Treatment of fever in at-home setting: See at-home auto-HSCT.

63.2.7 Incidence of Readmission in Outpatient and At-Home Allo-HSCT

Readmission rate is high (50–80%, according to the series) mainly due to organ toxicity associated with the preparative regimen in MAC with TBI and use of MTX or CY-PT such as GVHD prophylaxis.

The incidence of infection rate is lower than inpatient modality (15–30%, according to the series). Particularly, the incidence of *Aspergillus* or other mold infections was low (0–7%, according to series).

Severe GVHD is a low frequent cause of readmission in the first 30 days.

This incidence is related to the experience of the group of professionals and by the support infrastructure available in the hospital. In our experience, only 1 of the 28 patients (3.6%) required hospital readmission.

63.2.8 Quality of Life and Cost

The limited experience seems to show that at-home allo-HSCT modality improves nutrition/caloric intake, physical activity, and welfare of self that probably help to recover quickly and reduce toxicity, minimizing infection risk and GVHD (Svahn et al. 2008; Ringdén et al. 2013). Nevertheless, it is difficult to determine that these measures impact on a reduction of the total cost taking into account that the readmission rate is high and that most experiences include pre-planned booking of inpatient beds.

Key Points

- At home auto-HSCT is feasible and safe with a good selection of patients.
- At home auto-HSCT is cost-effective considering the patient setting, not analyzed in the context of the whole hospital budged.
- MM is the best indication for at-home auto-HSCT.
- With an adequate selection of patients, at-home allo-HSCT is feasible and safe.
- Allo-HSCT performed with the use of NMA and RIC conditioning regimens is the best option due to their inherent low organic toxicity.

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