Neue Immuntherapien bei Multiplem Myelom

bispezifische Antikörper & CART-Zelltherapie

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Interessenskonflikte

- Stockholder: nothing to disclose
- Employee: nothing to disclose
- Scientific Advisory boards and/or Honoraria:

Amgen, BMS/Celgene, Janssen, Takeda, Novartis, Sanofi, GSK, Pfizer, Abbvie, Stemline, Oncopeptides



Immunotherapy Era in Multiple Myeloma



Y Immunoglobulin



- Antibody–drug conjugate
 - Belantamab mafodotin-blmf
- BCMA-directed CAR T-cell therapy
 - Idecabtagene vicleucel
 - Ciltacabtagene autoleucel
- Bispecific antibodies
- Naked antibodies
- Multiple targets
 - BCMA
 - GPRC5D
 - FcHR5
 - SLAMF7



Cho. Front Immunol. 2018;9:1821. Su. J Hematol Oncol. 2021;14:115. Tai. Expert Opin Biol Ther. 2019;19:1143.

Triple class - refractory disease



Bispecific antibodies (targets BCMA, GPRC5D)



TECVAYLI® (TECLISTAMAB) DELIVERS HIGH RATES OF RAPID, DEEP AND DURABLE RESPONSES AND IMPROVES HRQoL FOR TRIPLE-CLASS-EXPOSED PATIENTS WITH RRMM MAJESTEC-1 study



1. Van de Donk NWCJ, et al. ASCO 2023. Poster 8011; 2. Martin T, et al. ASCO 2022. Poster 8033; 3. Moreau P, et al. *N Engl J Med* 2022;387:495–505; 4. Touzeau C, et al. ASCO 2022. Poster 8013; 5. Usmani SZ, et al. ASCO 2023. Poster 8034; 6. Moreau P, et al. *N Engl J Med* 2022;387:495–505 (protocol).



TECVAYLI® (TECLISTAMAB) DELIVERS HIGH RATES OF RAPID, DEEP AND DURABLE RESPONSES AND IMPROVES HRQoL FOR TRIPLE-CLASS-EXPOSED PATIENTS WITH RRMM

mPFS in patients who achieved ≥CR was 26.9 months (95% CI: 22.8–NE); mOS in patients who achieved ≥CR was not reached



*Data cut-off: 4 January 2023; median follow-up: 23 months.

1. Van de Donk NWCJ, et al. ASCO 2023. Poster 8011 (including supplementary material); 2. Martin T, et al. ASCO 2022. Poster 8033; 3. Usmani SZ, et al. ASCO 2023. Poster 8034.



TECVAYLI®(TECLISTAMAB)THERAPY IS WELL TOLERATED AND OFFERS A PREDICTABLE AND MANAGEABLE SAFETY PROFILE

CRS events were predictable, manageable and generally mild in severity (predominantly Grade 1/2). All CRS events fully resolved without treatment discontinuation

72.1% of patients (119/165) had a CRS event

Maximum toxicity grade:



CRS events were predominantly **low grade (Grade 1/2)**

There was only one Grade 3 CRS event among 165 patients

(0.6%; in a patient with concurrent pneumonia; time to resolution: 2 days)

The **majority** of CRS events occurred after **step-up and Cycle 1 doses**, with only six patients (3.6%) having CRS events in Cycle 2 or later¹ Median duration: **2 days** (range, 1–9)

Median time to onset after the most recent dose:

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•2 days (range, 1-6)
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CRS mitigation

- Step-up dosing (Day 1: 0.06 mg/kg; Day 3: 0.3 mg/kg)
- **Pre-treatment medicinal products** administered prior to each teclistamab dose in the step-up dosing schedule
 - Corticosteroids
 - Antihistamines
 - Antipyretics

CRS management

Parameter	N=165
Received supportive measures ^{\dagger} for CRS, n (%)	110 (66.7)
Tocilizumab	60 (36.4)
Low-flow oxygen by nasal cannula [‡]	21 (12.7)
Corticosteroids	14 (8.5)
Single vasopressor	1 (0.6)

*Assessed per the American Society for Transplantation and Cellular Therapy criteria; [†]A patient may have received >1 supportive therapy for CRS. Other supportive measures not listed include IV fluids ar 1. Moreau P, et al. *N Engl J Med* 2022;387:495–505 (and supplement); 2. Nooka A, et al. ASCO 2022. Oral presentation 8007; 3. Van de Donk NWCJ, et al. ASCO 2023. Poster 8011; 4. TECVAYLI[®] Fachinformation 08/2023



TECVAYLI® (TECLISTAMAB) THERAPY IS WELL TOLERATED AND OFFERS A PREDICTABLE AND MANAGEABLE SAFETY PROFILE

The overall incidence of neurotoxic events, including ICANS, was low with teclistamab therapy, and events were predominantly low grade (Grade 1/2). All neurotoxic events, including ICANS, fully resolved without treatment discontinuation



*This number might differ from graph values due to rounding; [†]TEAEs under the 'nervous system disorder' or 'psychiatric disorder' system organ class that were judged by the investigator to be related to study drug, including ICANS events; [‡]Includes supportive measures to treat ICANS. 1. Moreau P, et al. *N Engl J Med* 2022;387:495–505 (and supplement); 2. Nooka A, et al. ASCO 2022. Oral presentation 8007; 3. Van de Donk NWCJ, et al. ASCO 2023. Poster 8011.



TECVAYLI®(TECLISTAMAB)THERAPY IS WELL TOLERATED AND OFFERS A PREDICTABLE AND MANAGEABLE SAFETY PROFILE

Also reported in $200(-\pi/0/)$	N=	N=165		
All reported in $\geq 20\%$, n (%)	Any grade	Grade 3/4		
Haematological				
Neutropenia	118 (71.5)	108 (65.5)		
Anaemia	90 (54.5)	62 (37.6)		
Thrombocytopenia	70 (42.4)	37 (22.4)		
Lymphopenia	60 (36.4)	57 (34.5)		
Leukopenia	33 (20.0)	15 (9.1)		
Non-haematological				
Infections	132 (80.0)	91 (55.2)		
CRS	119 (72.1)	1 (0.6)		
Diarrhoea	56 (33.9)	6 (3.6)		
Pyrexia	52 (31.5)	1 (0.6)		
Fatigue	48 (29.1)	4 (2.4)		
COVID-19	48 (29.1)	35 (21.2)		
Nausea	45 (27.3)	1 (0.6)		
Cough	44 (26.7)	0		
Injection site erythema	43 (26.1)	0		
Arthralgia	42 (25.5)	1 (0.6)		
Headache	40 (24.2)	1 (0.6)		
Constipation	36 (21.8)	0		
Hypogammaglobulinaemia	34 (20.6)	3 (1.8)		

Across ~2 years of median follow-up, AEs remained predictable and manageable

The most common AEs remained CRS, cytopenias and infections

- 80.0% (132/165) of patients experienced an infection
- 20.6% (34/165) of patients experienced hypogammaglobulinaemia

Treatment discontinuations

• AEs leading to **discontinuation** were infrequent (<5%)

Deaths

• Seven treatment-related deaths occurred (four due to COVID-19)

No new safety signals were reported at ~2 years median follow-up

Data cut-off: 4 January 2023.³ 1. Moreau P, et al. *N Engl J Med* 2022;387:495–505; 2. Nooka A, et al. ASCO 2022 presentation 8007; 3. Van de Donk NWCJ, et al. ASCO 2023. Poster 8011.



Elranatamab, a B-cell maturation antigen (BCMA)-CD3 bispecific antibody, for patients with relapsed/refractory multiple myeloma: Extended follow up and biweekly administration from MagnetisMM-3

<u>Mohamad Mohty, MD¹</u>, Michael H. Tomasson, MD², Bertrand Arnulf, MD³, Nizar J. Bahlis, MD⁴, Paula Rodríguez-Otero, MD⁵, Joaquin Martinez-Lopez, MD⁶, Cyrille Touzeau, MD⁷, Hang Quach, MD⁸, Julien Depaus, MD⁹, Hisayuki Yokoyama, MD, PhD¹⁰, Salomon Manier¹¹, Noopur Raje, MD¹², Marc-Steffen Raab, MD¹³, Emma Searle, MD¹⁴, Eric Leip, PhD¹⁵, Sharon Sullivan, PhD¹⁵, Akos Czibere, MD, PhD¹⁶, Andrea Viqueira, MD¹⁷, Alexander M. Lesokhin, MD¹⁸

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EHA 2023 oral presentation S196



AEs of special interest - Infections:

- Infections were reported in 69.9% (grade 3/4, 39.8%; grade 5, 6.5%) of patients
- Among patients with quantitative Ig data (n=72), <u>98.6% had immune</u> paresis at baseline
- Overall, <u>43.1%</u> of patients received <u>IgG replacement</u> during the study

	Cohort A (N=123)		
Patients, n (%)	Any grade	Grade 3/4	Grade 5
Infection TEAEs in ≥5% of patients			
COVID-19–related ^a	36 (29.3)	19 (15.4)	2 (1.6)
Upper respiratory tract infection	20 (16.3)	0	0
Pneumonia	20 (16.3)	10 (8.1)	0
Sinusitis	13 (10.6)	2 (1.6)	0
Urinary tract infection	12 (9.8)	4 (3.3)	0
Sepsis	8 (6.5)	8 (6.5)	0
Bacteremia	7 (5.7)	2 (1.6)	0
CMV reactivation	7 (5.7)	2 (1.6)	0
Key infections occurring in <5% of patients ^b			
Pneumocystis jirovecii pneumonia	6 (4.9)	5 (4.1)	0
CMV infection	4 (3.3)	0	0
Adenoviral hepatitis	1 (0.8)	0	1 (0.8)
Adenovirus infection	1 (0.8) ^c	0	1 (0.8) ^c
Hepatitis B reactivation	1 (0.8)	0	0
Pneumonia adenoviral	1 (0.8) ^c	0	1 (0.8) ^c
Pneumonia cytomegaloviral	1 (0.8)	1 (0.8)	0
Pneumonia pseudomonal	1 (0.8)	0	1 (0.8)

Safety with Q2W dosing



Mohty M et al. #S196 EHA 2023



TALVEY[®] (Talquetamab) is a 'First-in-class' T-Cell redirector with a novel distinct target

Talquetamab is a new immunotherapy: a first-in-class T-cell redirector with a novel, distinct target and a new mechanism of action

Talquetamab can be sequenced pre- or post-BCMA

Talquetamab is a **first-in-class**, off-the-shelf BsAb targeting GPRC5D, a **novel antigen overexpressed** on malignant plasma cells





Tozeau C et al. #S191 EHA 2023



TALVEY® (Talquetamab) has a manageable safety profile

CRS rates and severity are in line with reported incidence for bispecifics



1. Touzeau C, et al. EHA 2023, Oral S191; 2. Chari A, et al. ASH 2022, Oral P157; 3. Rasche L, et al. EHA 2023, Poster P892; 4. TALVEY® Fachinformation 08/2023; 5. Martin G, et al. Cancer 2023



Talquetamab Side effects



~20% of patients experienced grade 3/4 infections, with low rates of opportunistic infections, discontinuations and deaths due to infections

relatively low grade3/4 infections ...



1. Touzeau C, et al. EHA 2023, Oral S191; 2. Chari A, et al. ASH 2022, Oral P157; 3. Rasche L, et al. EHA 2023, Poster P892; 4. TALVEY® Fachinformation 08/2023





Prospective cohorts with change in AE status after switch vs matched cohort without dose reduction^a

33.3

6.7

Oral toxicity

26.9

3.1

Nail toxicity

12.0

3.3

11.1

11.1

Weight loss

18.9

6.6

53.8

12.5

12.5

37.5



Trend toward improved resolution of GPRC5D-related AEs, except weight loss •

Chiari A et al, oral presentation #1010, ASH 2023



CARTs (targeting BCMA)



Grundprinzip der CAR-T-Zelltherapie



2. Transduktion:

Gene für chimäre Antigenrezeptoren (CAR) werden viral in isolierte T-Zellen eingebracht.

3. Expression:

T-Zellen können nun funktionale CARs auf ihrer Oberfläche exprimieren.

4. Expansion:

Modifizierte T-Zellen werden vermehrt und für die Infusion vorbereitet.

CAR: Chimärer Antigenrezeptor



Rezente Zulassungserweiterungen:

ABECMA® Idecabtagene vicleucel RRMM nach ≥ 3 Therapien inkl. PI, IMiD, CD38 Ab

≥ 2 Therapien inkl. Dara, Pl und IMiD, Progress auf letzte Therapie

CARVYKTI® *Ciltacabtagene autoleucel* RRMM nach ≥ 3 Therapien inkl. PI, IMiD, CD38 Ab

≥ 1 Therapie inkl. PI und IMiD, Len-refraktär und Progress auf letzte Therapie



Idecabtagene vicleucel versus standard regimens in patients with triple-class-exposed relapsed and refractory multiple myeloma: updated analysis from KarMMa-3

Paula Rodríguez-Otero,¹ Sikander Ailawadhi,² Bertrand Arnulf,³ Krina K. Patel,⁴ Michele Cavo,⁵ Ajay K. Nooka,⁶ Salomon Manier,⁷ Natalie Callander,⁸ Luciano J. Costa,⁹ Ravi Vij,¹⁰ Nizar J. Bahlis,¹¹ Philippe Moreau,¹² Scott Solomon,¹³ Ingerid Weum Abrahamsen,¹⁴ Rachid Baz,¹⁵ Annemiek Broijl,¹⁶ Christine Chen,¹⁷ Sundar Jagannath,¹⁸ Noopur Raje,¹⁹ Christof Scheid,²⁰ Michel Delforge,²¹ Reuben Benjamin,²² Thomas Pabst,²³ Shinsuke Iida,²⁴ Jesus Berdeja,²⁵ Anna Truppel-Hartmann,²⁶ Rashmi Bhatnagar,²⁷ Fan Wu,²⁸ Julia Piasecki,²⁸ Laurie Eliason,²⁸ Devender Dhanda,²⁸ Jasper Felten,²⁹ Andrea Caia,²⁹ Mark Cook,²⁹ Mihaela Popa McKiver,²⁸ Sergio Giralt³⁰



Secondary endpoint	lde-cel (n = 254)	Standard regimens (n = 132)	
CR rate (95 % CI), % ^d	44 (38-50)	5 (2-9)	
MRD-negative CR rate, n/N (%) (95% CI) ^e	57/163 (35) (28-42)	1/54 (2) (0-5)	
Median (95% CI) DOR, months	16.6 (12.1-19.6)	9.7 (5.5-16.1)	
Median PFS2, months	23.5	16.7	
HR (95% CI)	0.79 (0.60-1.04)		

Treated population, n (%)	lde-cel (n = 225)
CRS ^b .	
Any grade	197 (88)
Grade 3/4	9 (4)
<u>iint</u> ,	
Any grade	34 (15)
Grade 3/4	7 (3)
Infections	
Any grade	125 (56)
Grade 3/4	50 (22)

Keine Langzeit-Toxizitäten i.S. Parkinsonismus oder Guillain/Barre' No SPMs of T-cell origin

Rodriguez-Otero P et al, oral presentation #1028, ASH 2023



Ide-cel versus standard of care regimens in patients with triple class-exposed RRMM: Updated analysis of the KarMMa-3 study



- ORR was 71% in ide-cel vs 42% in SoC
- sCR/CR was 44% in ide-cel vs 6% in SoC
- MRD-ve CR rate was 35% vs 2%

Rodriguez-Otero P, et al. ASH 2023 (Abstract No. 1028 – oral presentation).



MEDICAL UNIVERSITY OF VIENNA CARTITUDE-1 Final Results: Phase 1b/2 Study of Ciltacabtagene Autoleucel in Heavily Pretreated Patients With Relapsed/Refractory Multiple Myeloma

Yi Lin¹, Thomas G Martin², Saad Z Usmani³, Jesus G Berdeja⁴, Andrzej J Jakubowiak⁵, Mounzer E Agha⁶, Adam D Cohen⁷, Abhinav Deol⁸, Myo Htut⁹, Alexander M Lesokhin³, Nikhil C Munshi¹⁰, Elizabeth O'Donnell¹¹, Carolyn C Jackson¹², Tzu-Min Yeh¹², Arnob Banerjee¹³, Enrique Zudaire¹³, Deepu Madduri¹², Christopher delCorral¹⁴, Lida Pacaud¹⁴, Sundar Jagannath¹⁵

CARTITUDE-1 Final Results: Study Population (~3-Year Follow-Up)



Munshi N et al. #S202 EHA 2023

 Lin Y, et al. ASCO 2023 (Abstract No. 8009 - oral presentation); 2. Press release. Available at: https://www.fda.gov/vaccines-blood-biologics/safety-availability-biologics/fda-investigating-serious-risk-t-cell-malignancy-following-bcma-directed-or-cd19-directed-autologous (last accessed January 2024);
 Harrison SJ, et al. Blood 2023;142(Supplement 1):6939.





Safety profile:

No new neurotoxic events;

FDA warning about T- cell malignancies and SPM in general²

26 SPM reported throughout the study in 20 patients including 7 MDS, 1 B-cell NHL and 3 AML

T-cell malignancies: 1 case reported with cilta-cel³

Phase 3 Results From CARTITUDE-4: Cilta-cel Versus Standard of Care (PVd or DPd) in Lenalidomide-Refractory Multiple Myeloma

Binod Dhakal¹, Kwee Yong², Simon Harrison³, María-Victoria Mateos⁴, Philippe Moreau⁵, Niels WCJ van de Donk⁶, Surbhi Sidana⁷, Rakesh Popat⁸, Nikoletta Lendvai⁹, Carolina Lonardi¹⁰, Ana Slaughter¹¹, Jordan M Schecter⁹, Katherine Li¹², Enrique Zudaire¹², Diana Chen¹³, Jane Gilbert¹⁴, Lida Pacaud¹⁵, Nitin Patel¹⁵, Jesús San-Miguel¹⁶, Hermann Einsele¹⁷

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Figure 7: CARTITUDE-4 Study: Kaplan-Meier Plot for Overall Survival (ITT Analysis Set; 13 December 2023 Survival Sweep)

Wichtig zu wissen **VOR** CART-Zelltherapie: Optimierung des klinischen Outcomes



Patientenselektion für eine CAR-T Zell-Therapie beim Multiplen Myelom

Auswahlkriterien

- Erhaltene
 Organfunktionen
 (EF > 45%, NYHA < 2,
 SpO₂ > 91%, LFP < 2,5
 ULN, eGFR >30 ml/min*)
- Keine schwere Zytopenie (ANC > 1,0 G/I, PLT > 50 G/I, Hb > 8 g/dI)
- Keine aktive ZNS-Beteiligung oder neurolog. Erkrankung
- ECOG ≤ 2*

Risikofaktoren für kürzeres/schlechteres Ansprechen

- ISS III
- High-Risk Zytogenetik
- Hohe Tumormasse
- EMD (paraskelettal ≠ Weichteil)
- û inflammatorische Biomarker vor CAR-T
- "Exhausted" T-Zell-Profil (î CD4+ Treg cell like phenotype, ↓ CD8+ stem-cell like phenotype)

Risikofaktoren für erhöhtes Komplikationsrisiko

- Hohe Tumormasse
- CRS \geq Grad 2
- ICANS
- Neurolog. Vorerkrankung
- îr inflammatorische Biomarker vor CAR-T
- Schwere Zytopenien vor CAR-T
- ⁽¹⁾ CAR-T Peak Expansion

*basierend auf MM Real World Daten, entspricht nicht den aktuellen CAR-T Plattform Kriterien; Hansen DK et al, JCO 2023; Hansen DK et al, #8012, ASCO 2023 Greinix H et al, memo 2020; Martin T et al, JCO 2023; Montes de Oca R et al, #2099 ASH 2023; Cohen AD et al, Blood Cancer J 2022; Rejeski K et al, J Hematol Oncol 2023



Rolle der bridging therapie ...

Debulking of the disease burden leads to prolonged PFS



Ide-cel combined with effective bridging strategy can be associated with more durable PFS

PFS per IRC based on IMWG criteria according to FDA censoring rules. ^aMedian and 95% CI are based on Kaplan-Meier approach. Einsele, et al. IMS 2023. [Poster P-008]



Extramedulläre Erkrankung ...

- 4/2017 2/2023; n=134; mFU: 19 Monate; n=59 Ciltacel; n=52 Idecel; n=23 sonstige;
- Bei 28/34 EMD-Rezidiv wurde KM auf MRD untersucht, davon 43% MRD- in next-generation-flow (10-5)

	EMD+ (%)	PMD+ (%)	EMD-, PMD-
PFS	HR 1,87, 95% KI 1,13-3,09	HR 0,98, 95% CI 0,51-1,87	1,0
os	HR 3,78, 95% KI 1,81-7,92	HR 1,34, 95% CI 0,48-3,76	1,0
ORR (%)	77 (57 für SPD ≥50cm² (n=7), davon 3 PD, 3 PR, 1 VGPR) (82 für SPD <50cm² (n=27), davon 18 CR)	92	88



- EMD (Ø PMD): sig. schlechteres PFS + OS post-CAR-Ts; EMD+ SPD <50cm² zeigt besseres Ansprechen
- Mehrheit mit Baseline-EMD erlitt Rezidiv trotz radiografisch post-CAR T EMD-; 43% der EMD-Rezidive post-CAR T blieben MRDim KM
- EMD-Kontrolle vor CAR-Ts mit optimalem Bridging u/od. Radiatio
- KM-MRD allein: Ø gutes Maß für Gesamterkrankungskontrolle post-CAR T

Pan D et al, oral presentation #1006, ASH 2023



Vielen Dank für Ihre Aufmerksamkeit!

