

Effectiveness and safety of ustekinumab in ulcerative colitis:**Real-world evidence from the ENEIDA registry**

María Chaparro¹ M.D., Ph.D., Ana Garre¹ Sc., Marisa Iborra² M.D., Ph.D., Mónica Sierra³, Manuel Barreiro-de Acosta⁴ M.D., Ph.D., Agnés Fernández-Clotet⁵ M.D., Luisa de Castro⁶ M.D., Ph.D., Maia Boscá-Watts⁷ M.D., María José Casanova¹ M.D., Ph.D., Alicia López-García⁸ M.D., Rufo Lorente⁹ M.D., Cristina Rodríguez¹⁰ M.D., Ana Y Carbajo¹¹ M.D., Maria Teresa Arroyo¹² M.D., Ph.D., Ana Gutiérrez¹³ M.D., Ph.D., Joaquín Hinojosa¹⁴, Teresa Martínez-Pérez¹⁵ M.D., Albert Villoria¹⁶ M.D., Fernando Bermejo¹⁷ M.D., Ph.D., David Busquets¹⁸ M.D., Blau Camps¹⁹ M.D., Fiorella Cañete²⁰ M.D., Noemí Manceñido²¹ M.D., Ph.D., David Monfort²² M.D., Mercè Navarro-Llavat²³ M.D., José Lázaro Pérez-Calle²⁴ M.D., Laura Ramos²⁵ M.D., Montserrat Rivero²⁶ M.D., Ph.D., Teresa Angueira²⁷ M.D., Patricia Camo²⁸ M.D., Daniel Carpio²⁹ M.D., Irene García-de-la-Filia³⁰ M.D., Carlos González-Muñoz³¹ M.D., Luis Hernández³² M.D., José M. Huguet³³ M.D., Víctor J Morales³⁴ M.D., Beatriz Sicilia³⁵ M.D., Ph.D., Pablo Vega³⁶ M.D., Isabel Vera³⁷ M.D., Ph.D., Yamile Zabana³⁸ M.D., Ph.D., Pilar Nos² M.D., Ph.D., Patricia Suárez Álvarez³ M.D., Cristina Calviño-Suarez⁴ M.D., Elena Ricart⁵ M.D., Ph.D., Vicent Hernández⁶ M.D., Ph.D., Miguel Mínguez⁷ M.D., Lucía Márquez⁸ M.D., Daniel Hervías Cruz⁹ M.D., Saioa Rubio Iturria¹⁰ M.D., Jesús Barrio¹¹, M.D., Carla Gargayo-Puyuelo¹² M.D., Rubén Francés³⁹ M.D., Ph.D., Esther Hinojosa¹⁴ Sc., María del Moral¹⁵ M.D., Xavier Calvet¹⁶ M.D, Ph.D., Alicia Algaba¹⁷ PhD, Xavier Aldeguer¹⁸ M.D, Ph.D., Jordi Guardiola¹⁹ M.D, Ph.D., Miriam Mañosa²⁰ M.D., Ph.D., Ramón Pajares²¹ M.D., Marta Piqueras²² M.D., Orlando García-Bosch²³,M.D., Pilar Lopez Serrano²⁴ M.D., Ph.D., Beatriz Castro²⁶ M.D., Alfredo J Lucendo²⁷ M.D., Ph.D., Miguel Montoro²⁸ M.D, Ph.D., Elena Castro Ortiz²⁹ M.D., Francisco Mesonero³⁰ M.D., Esther García-Planella³¹ M.D, Ph.D., David A. Fuentes³² M.D., Inmaculada Bort³³ M.D., Pedro Delgado-Guillena³⁴ MD., Lara Arias³⁵ M.D., Agueda Iglesias³⁶ Study nurse, Marta Calvo³⁷ M.D., Maria Esteve³⁸ M.D., Ph.D., Eugeni Domènech²⁰ M.D., Ph.D. and Javier P. Gisbert¹ M.D., Ph.D.

Gastroenterology Departments of: Hospital Universitario de La Princesa, Instituto de Investigación Sanitaria Princesa (IIS-IP), Universidad Autónoma de Madrid, and Centro de Investigación Biomédica en Red de Enfermedades Hepáticas y Digestivas (CIBERehd), Madrid, Spain; ²Hospital Universitario y Politécnico La Fe and CIBERehd, Valencia, Spain; ³Complejo Asistencial Universitario de León, León, Spain; ⁴Hospital Clínico Universitario de Santiago, Santiago de Compostela, Spain; ⁵Hospital Clínic i Provincial and CIBERehd, IDIBAPS, Barcelona, Spain; ⁶Xerencia Xestión Integrada de Vigo, SERGAS. Vigo. Research Group in Digestive Diseases, Galicia Sur Health Research Institute (IIS Galicia Sur). SERGAS-UVIGO. Spain; ⁷Hospital Clínico de Valencia. Universitat de València, Valencia, Spain; ⁸Hospital del Mar and Institut Hospital del Mar d'Investigacions Mèdiques, Barcelona, Spain; ⁹Hospital General Universitario de Ciudad Real, Ciudad Real, Spain; ¹⁰Complejo Hospitalario de Navarra, Navarra, Spain; ¹¹Hospital Universitario Río Hortega. Gerencia Regional de Salud de Castilla y León (SACYL). Valladolid, Spain; ¹²HCU Lozano Blesa, IIS Aragón and CIBERehd, Zaragoza, Spain; ¹³Hospital General Universitario de Alicante and CIBERehd, IIS ISABIAL Alicante, Spain; ¹⁴Hospital de Manises, Valencia, Spain; ¹⁵Hospital Virgen de la Luz, Cuenca, Spain; ¹⁶Hospital Parc Taulí, Sabadell. Departament de Medicina. Universitat Autònoma de Barcelona and CIBERehd, Spain; ¹⁷Hospital Universitario Fuenlabrada and Instituto de Investigación Sanitaria del Hospital La Paz (IdiPAZ), Madrid, Spain; ¹⁸Hospital Universitario de Girona Dr. Josep Trueta, Girona, Spain; ¹⁹Hospital Universitario de Bellvitge, Barcelona, Spain; ²⁰Hospital Universitari Germans Trias i Pujol and CIBERehd, Badalona, Spain; ²¹Hospital Infanta Sofía, San Sebastián de los Reyes, Spain; ²²Consorci Sanitari de Terrassa, Terrassa, Spain; ²³Hospital de Sant Joan Despí Moisès Broggi, Barcelona, Spain; ²⁴Hospital Universitario Fundación Alcorcón, Madrid, Spain; ²⁵Hospital Universitario de Canarias, Santa Cruz de Tenerife, Spain; ²⁶Hospital Universitario Marqués de Valdecilla and IDIVAL, Santander, Spain; ²⁷Hospital General de Tomelloso and CIBERehd, Ciudad Real, Spain; ²⁸Hospital General San Jorge, Huesca, Spain; ²⁹Complejo Hospitalario Universitario de Pontevedra, Pontevedra, Spain; ³⁰Hospital Universitario Ramon y Cajal, Madrid, Spain; ³¹Hospital de la Santa Creu i Sant Pau, Barcelona, Spain; ³²Hospital Santos Reyes, Burgos, Spain; ³³Hospital General Universitario de Valencia, Valencia, Spain; ³⁴Hospital General de Granollers, Barcelona, Spain; ³⁵Hospital Universitario de Burgos, Burgos, Spain; ³⁶Complejo Hospitalario Universitario de Ourense, Ourense, Spain; ³⁷Hospital Universitario Puerta de Hierro Majadahonda, Madrid, Spain; ³⁸Hospital Universitario Mútua Terrassa and CIBERehd, Terrassa, Spain; ³⁹Hepatic and intestinal Immunobiology group Clínica Medicina, Department Miguel Hernández University, IIS ISABIAL, Hospital General Universitario de Alicante and CIBERehd, Alicante, Spain.

ABBREVIATIONS: Ulcerative colitis (UC), Crohn's disease (CD), Partial Mayo Score (PMS), C-reactive protein (CRP), standard deviation (SD), interquartile range (IQR), *Odds ratio* (OR).

AUTHOR CONTRIBUTIONS

María Chaparro and Javier P. Gisbert: Study design, data collection, data analysis, data interpretation, writing the manuscript.

Ana Garre: Data monitoring.

Rest of Patient inclusion.

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CORRESPONDENCE

María Chaparro, M.D., Ph.D.

Inflammatory Bowel Disease Unit

Department of Gastroenterology

Hospital Universitario de La Princesa

Diego de León, 62. 28006 Madrid, Spain

Tel.: 34-913093911; Fax: 34-915204013

e-mail: mariachs2005@gmail.com

Conflict of interest

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Abstract

Background: The development program (UNIFI) has shown promising results of ustekinumab in ulcerative colitis (UC) treatment that should be confirmed in clinical practice.

Aims: To evaluate the durability, effectiveness and safety of ustekinumab in UC in real-life.

Methods: Patients included in the prospectively maintained ENEIDA registry who received at least one intravenous dose of ustekinumab due to active UC [Partial Mayo Score (PMS) >2] were included. Clinical activity and effectiveness were defined based on PMS. Short-term response was assessed at week 16.

Results: A total of 95 patients were included. At week 16, 53% of patients had response (including 35% of patients in remission). In the multivariate analysis, elevated serum C-reactive protein was the only variable significantly associated with lower likelihood of achieving remission. Remission was achieved in 39% and 33% of patients at weeks 24 and 52, respectively. Thirty-six percent of patients discontinued the treatment with ustekinumab during a median follow-up of 31 weeks. The probability of maintaining ustekinumab treatment was 87% at week 16, 63% at week 56, and 59% at week 72; primary failure was the main reason for ustekinumab discontinuation. No variable was associated with risk of discontinuation. Three patients reported adverse events; one of them had a fatal severe SARS-CoV-2 infection.

Conclusions: Ustekinumab is effective both in the short and the long-term in real-life, even in a highly refractory cohort. Higher inflammatory burden at baseline correlated with lower probability of achieving remission. Safety was consistent with the known profile of ustekinumab.

KEYWORDS: ustekinumab, ulcerative colitis, response, remission, durability, real-world evidence.

Introduction

The UNIFI trial has demonstrated the superiority of ustekinumab over placebo in inducing and maintaining remission in patients with active ulcerative colitis (UC), not only in naïve patients but also in those who failed previous biological agents with a good safety profile¹. These promising results should be confirmed in clinical practice, where the experience with ustekinumab in clinical practice, in terms of both effectiveness and safety, is still limited^{2,3}.

We performed the present study aiming to evaluate the durability of ustekinumab treatment in UC patients in clinical practice. Our secondary aims were to assess the short-term response (at week 16) and the long-term effectiveness (at maximum follow-up), to identify predictive factors of response, to describe the schedules of ustekinumab administration in UC in real-life and the need for dose adjustments, and finally, to assess the safety of ustekinumab in clinical practice.

Case report

Methods

Study design

This was an observational multicentre study carried out with data from ENEIDA project⁴. Patients 18 years of age or older, who received at least one intravenous dose of ustekinumab at least 16 weeks before data analysis due to active UC [Partial Mayo Score (PMS)>2] were included. Patients who received ustekinumab for an indication other than UC while in remission or with a previous colonic resection were excluded. Patients were followed-up until last ustekinumab administration or last visit, whichever came first. Data were remotely monitored to assess data quality. ENEIDA project was approved by Research Ethic Committees in all participating centres. Written informed consent to be enrolled in ENEIDA registry was obtained from all patients.

Variables collected and definitions used in the study are described in Supplemental material (Annex 1 and 2).

Evaluation of effectiveness

The assessment of ustekinumab effectiveness was based on the PMS. For the short-term efficacy analysis, the proportion of patients achieving remission or response after the induction (week 16) was calculated. In the long-term, the proportion of patients in remission and steroid-free remission at weeks 24 and 52 were calculated. Patients who discontinued ustekinumab owing to lack of therapeutic effect, an adverse event or worsening of UC before their last visit were considered as not having achieved the endpoint (remission or response) at subsequent time points, and therefore, they were considered failures. Dose adjustment was considered to be part of the treatment regimen (i.e., not included in treatment failure rules) unless otherwise indicated for dichotomous endpoints (remission vs. no remission at a certain time point).

Statistical analysis

The statistical analysis is described in Annex 3 in Supplementary Material.

Results

Patient characteristics

A total of 95 patients were included, with a median time of exposure to ustekinumab of 31 weeks (IQR=18-59 weeks). The main characteristics of the study population are summarised in table 1.

Short-term effectiveness

After the induction (week 16), 33 patients (35%) reached clinical remission and 50 (53%) reached clinical response (including patients with response) (Figure 1).

The schedule for the induction varied widely between patients. All of them received a first intravenous dose of approximately 6 mg/kg. Ninety-one patients received a second dose of ustekinumab while 4 interrupted the treatment before administration of the second dose; 51 of them (56%) received the second dose between weeks 6 and 10, 8 (9%) before week 6, 21 patients (23%) at week 11, 5 (5%) at week 12 and 6 (6%) after week 12.

Eighty-four patients received a third dose of ustekinumab. In most of the cases (80%) administration was between weeks 16 and 20. Fourteen patients (17%) received the third dose before week 16, and 3 patients (3.5%) after week 20.

At baseline, the proportion of patients with elevated CRP (above the normal range limit) and the proportion of patients with severe endoscopic activity were significantly lower in patients who achieved remission at week 16 than in those who did not achieve remission, (52% vs. 75% $p<0.05$) and (50 vs. 74%, $p<0.05$), respectively (table 2). In the multivariate analysis, CRP above the normal range limit at baseline was the only variable associated with lower probability of achieving remission at week 16 [*odds ratio* (OR)=0.3, 95%CI=0.1-0.7].

Ustekinumab durability

A total of 34 patients (36%) discontinued ustekinumab over time; median time of exposure to ustekinumab was 31 weeks (IQR=18-59). The probability of maintaining ustekinumab treatment was 87% at week 16, 63% at week 56, and 59% at week 72 (Figure 2). The reasons for ustekinumab discontinuation were: primary non-response in 21 patients (22%), loss of response in 12 patients (13%) and adverse event in 1 patient (1%). Neither

the univariate nor the multivariate analysis found any variable associated with ustekinumab discontinuation. Fifty-three patients were under steroids at baseline, and 35 (66%) were able to stop them.

Long-term effectiveness and dose adjustments

Of 83 patients who started ustekinumab at least 24 weeks before data analysis, 32 (39%) were in remission at week 24, and 25 (30%) in steroid-free remission. Fifty-four patients started ustekinumab at least 52 weeks before data analysis; at week 52, 18 (33%) of them were in remission, and 17 (32%) in steroid-free remission (Figure 3).

Eighty-one patients started the maintenance phase (at week 16). Thirty patients were in remission at that moment. Three patients (10%) started the maintenance phase with every-12-week schedule, 24 patients (80%) with every-8-weeks schedule, and 3 (10%) with intensified schedule (every-6-weeks or every-4-weeks). Two patients had to interrupt the treatment due to loss of response and one patient due to clinician's choice during follow-up. Ten patients relapsed during follow-up: 4 intensified the dose (2 reached remission again), 2 interrupted the treatment, and in 4 the change in treatment was unknown.

On the other hand, 51 patients started the maintenance phase despite having active disease at week 16. Three patients (6%) started with every-12-weeks schedule, 36 (71%) with every-8-weeks, and 12 (23%) with intensified schedule. Of those patients who were not in remission at week 16, 21 (41%) ended-up stopping the treatment during follow-up, 13 (25%) maintained the treatment during follow-up despite never reaching remission, and 17 (34%) reached remission later on during follow-up.

A total of 66 patients started the maintenance phase with the standard dose (either every-12-weeks or every-8-weeks schedule); of them, 18 patients intensified the treatment —10 (55%) due to primary failure, 3 (17%) due to partial response and 5 (28%) due to loss of

response. One among 10 patients with primary failure and 2 among 5 patients with loss of response achieved remission after dose intensification. None of the 3 patients who intensified the dose due to partial response reached remission. Finally, 1 patient escalated the dose from every-12-weeks to every-8-weeks due to loss of response and reached remission after dose optimization.

A total of 9 patients (9.5%) needed to undergo colectomy due to ustekinumab failure. Median time from ustekinumab start to surgery was 14 weeks (IQR=7.5-18).

Adverse events

Three adverse events were reported in our cohort. A patient developed dry skin and itching probably related with ustekinumab. The symptoms were mild and did not lead to treatment discontinuation. Another patient had pneumonia probably not related to ustekinumab treatment which did not cause treatment discontinuation. Finally, a 54-year-old male with extensive UC and no comorbidities, who had been exposed to ustekinumab for 43 weeks, developed severe SARS-Cov-2 pneumonia and died. At the time of infection, the patient had been treated with ustekinumab 90 mg every-6-weeks for 43 weeks without steroids or immunomodulators, after previously failing infliximab, adalimumab, golimumab, vedolizumab and tofacitinib.

Discussion

To our knowledge this is the largest study to date providing real-life evidence on the long-term benefit of ustekinumab treatment in UC patients. In our cohort, one-third of patients were able to achieve remission after the induction (week 16), despite being highly refractory patients (80% had failed both anti-TNF agents and vedolizumab, and 30% anti-TNF agents, vedolizumab and tofacitinib). In addition, one third of patients achieved steroid-free remission during follow-up (week 24 and week 52).

To date, only one previous real-life study has assessed the short-term effectiveness of ustekinumab in UC patients². In this study, at weeks 12-16, 39.8% of patients had clinical remission. This figure is quite similar to ours: 34.7% of patients were in remission at week 16.

We found that CRP serum concentration over the normal range upper limit was the only factor significantly associated with lower probability of achieving remission. Similarly, Amiot et al observed that patients with PMS>6 had significantly lower chance of achieving remission in the short-term². Those findings suggest that the inflammatory burden has a significant impact on ustekinumab effectiveness during the induction in UC patients. Other factors, such as concomitant treatment with immunomodulators or the number of previous biologics do not seem to have an impact on treatment response.

The long-term effectiveness of ustekinumab in UC in real life has hardly been studied. Ochsekühn et al. published a retrospective series of 19 UC patients treated with ustekinumab³. The main aim was to know the proportion of patients in clinical remission at one year; 53% of patients (10/19) had clinical remission after 12 months of treatment.

Our study provides some relevant findings on the long-term real-life effectiveness of ustekinumab treatment in UC. With respect to drug survival, we observed that the proportion of patients maintained under ustekinumab treatment was over 60% at 12 months, being primary failure the main reason for ustekinumab discontinuation. These results are similar to those reported for other drugs in particularly refractory patient populations⁵⁻⁷. We acknowledge that ustekinumab might have been maintained in some patients, despite not reaching clinical remission, as the last medical option to avoid surgery. However, ustekinumab might have exerted some effect even in those patients avoiding colectomy (less than 10% of our patients ended-up undergoing surgery).

Approximately one-third of patients who were in remission at week 16 in our cohort, relapsed during follow-up (median time of exposure to ustekinumab was 31 weeks). Dose

was optimized in 4 patients, and 2 of them regained remission. Ustekinumab dose intensification seems to be useful to regain remission in CD patients^{8,9}; however, data in UC patients are lacking. The role of dose intensification in UC patients losing response to ustekinumab needs to be further studied.

Finally, the potential role of concomitant therapy with immunomodulators is of great interest to optimize the treatment in clinical practice. Evidence from CD studies supports that combo treatment with thiopurines does not increase either the short or the long-term effectiveness of ustekinumab¹⁰. In our cohort, combo treatment was not associated either with the probability of achieving short-term remission or with the durability of ustekinumab treatment in the long-term.

With respect to the safety profile, our results are consistent with those previously reported for ustekinumab¹¹.

In conclusion, ustekinumab is effective in inducing remission in up to one-third of UC patients, even in a highly refractory population. Patients with higher inflammatory burden are less likely to achieve short-term remission. Over 60% of patients maintained ustekinumab treatment at 12 months, suggesting that it also provides benefit in the long-term. The safety profile is similar to the previously described for ustekinumab.

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Table 1. Characteristics of the study population.

Characteristics	
Mean age (SD) (years)	47 (16)
Median time of follow-up (IQR) (weeks)	82 (41-153)
Female gender, n (%)	53 (56)
UC extent	
Extensive colitis, n (%)	55 (58)
Left-sided colitis, n (%)	37 (39)
Proctitis, n (%)	3 (3)
Extraintestinal manifestations, n (%)	27 (28)
Smokers, n (%)	4 (4)
Family history, n (%)	7 (8)
Median partial Mayo score at baseline (IQR)	6 (4-8)
Endoscopic assessment at baseline, n (%)	68 (72)
Mild, n (%)	3 (4)
Moderate, n (%)	20 (30)
Severe, n (%)	45 (66)
Baseline CRP over the upper limit of normal range, n (%)	61 (64)
Anaemia at baseline, n (%)	38 (40)

Median faecal calprotectin at baseline (IQR) ($\mu\text{g/g}$)	1,56 4 (795- 2,99 8)
Prior biological treatment or tofacitinib, n (%)	95 (100)
Anti-TNF, n (%)	93 (98)
Vedolizumab, n (%)	78 (82)
Tofacitinib, n (%)	28 (30)
Anti-TNF and vedolizumab, n (%)	76 (80)
Anti-TNF, vedolizumab and tofacitinib, n (%)	27 (28)
Prior number of biological agents	
1-2 previous biologics, n (%)	40 (42)
≥ 3 previous biologics, n (%)	55 (58)
Concomitant immunosuppressants, n (%)	16 (17)
Steroids during induction, n (%)	53 (56)

Ulcerative colitis, UC; standard deviation, SD: interquartile range, IQR; C-reactive protein, CRP; tumour necrosis factor, TNF.

Table 2. Distribution of different variables according to achievement of remission at week 16.

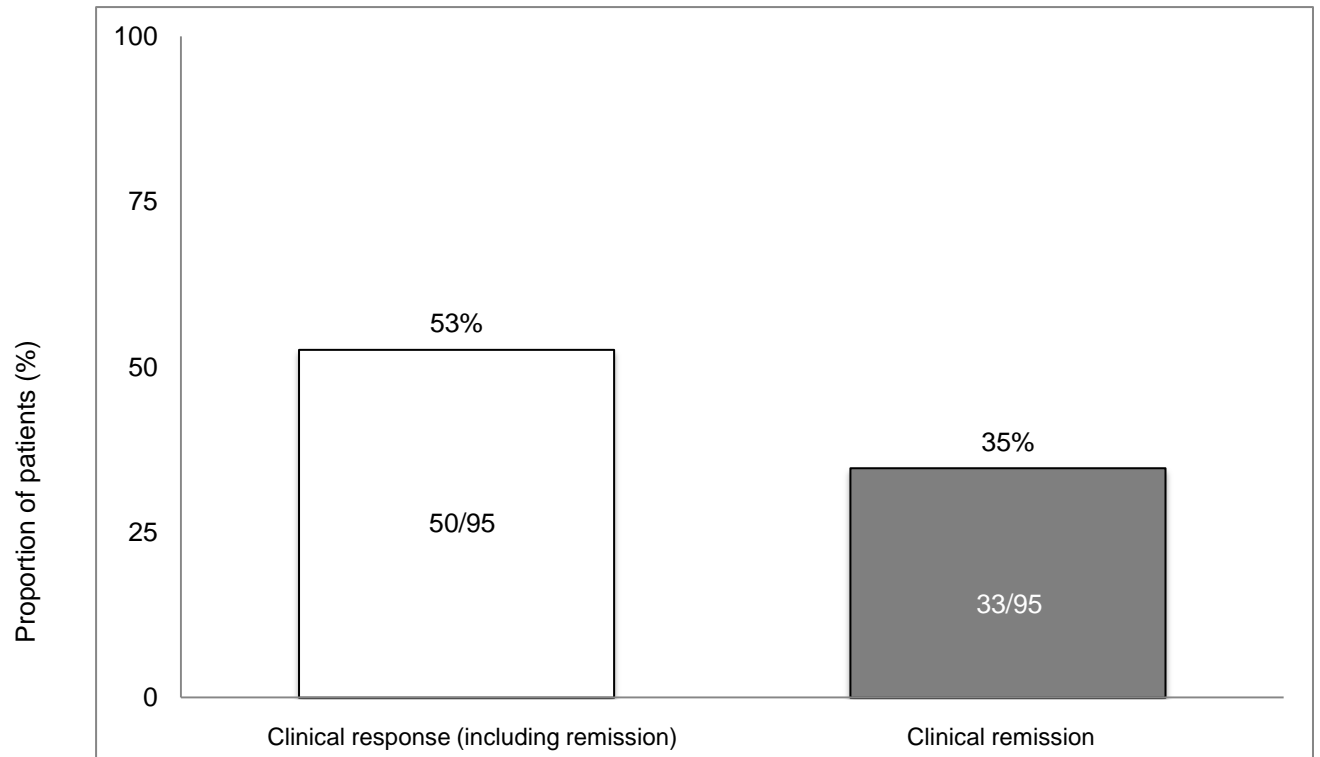
Variable	No remission N=62	Remission N=33	p
Mean age (years) (SD)	46.5 (2)	47 (3)	n.s.
Female gender, n (%)	34 (55)	19 (59.4)	n.s.
Extensive colitis, n (%)	32 (52)	22 (69)	n.s.
Extraintestinal manifestations, n (%)	17 (27)	10 (30)	n.s.
Smokers, n (%)	1 (1.7)	3 (10)	n.s.
Family history, n (%)	4 (6.9)	3 (10.7)	n.s.
Median partial Mayo score at baseline (months) (IQR)	6 (5-8)	6 (3-6)	n.s.
Endoscopic assessment at baseline, n (%)	46 (74)	22 (67)	
Mild, n (%)	0 (0)	3 (14)	
Moderate, n (%)	12 (26)	8 (36)	<0.05
Severe (%)	34 (74)	11 (50)	
Baseline CRP over the upper limit of normal range, n (%)	45 (79)	16 (52)	<0.05
Anaemia at baseline, n (%)	25 (42)	13 (43)	n.s.
Median faecal calprotectin at baseline ($\mu\text{g/g}$)	1,625	1,281	n.s.
Prior biological treatment or tofacitinib			
Anti-TNF, n (%)	61 (98)	32 (97)	n.s.
Vedolizumab, n (%)	53 (86)	25 (76)	n.s.

Tofacitinib, n (%)	19 (31)	9 (27)	n.s.
Median prior number of biologic agents (IQR)	3 (2-3)	2 (2-3)	n.s.
Concomitant immunosuppressants, n (%)	11 (18)	5 (15)	n.s.
Steroids during induction, n (%)	36 (58)	17 (52)	n.s.

Standard deviation, SD; interquartile range, IQR; C-reactive protein, CRP; tumour necrosis factor, TNF.

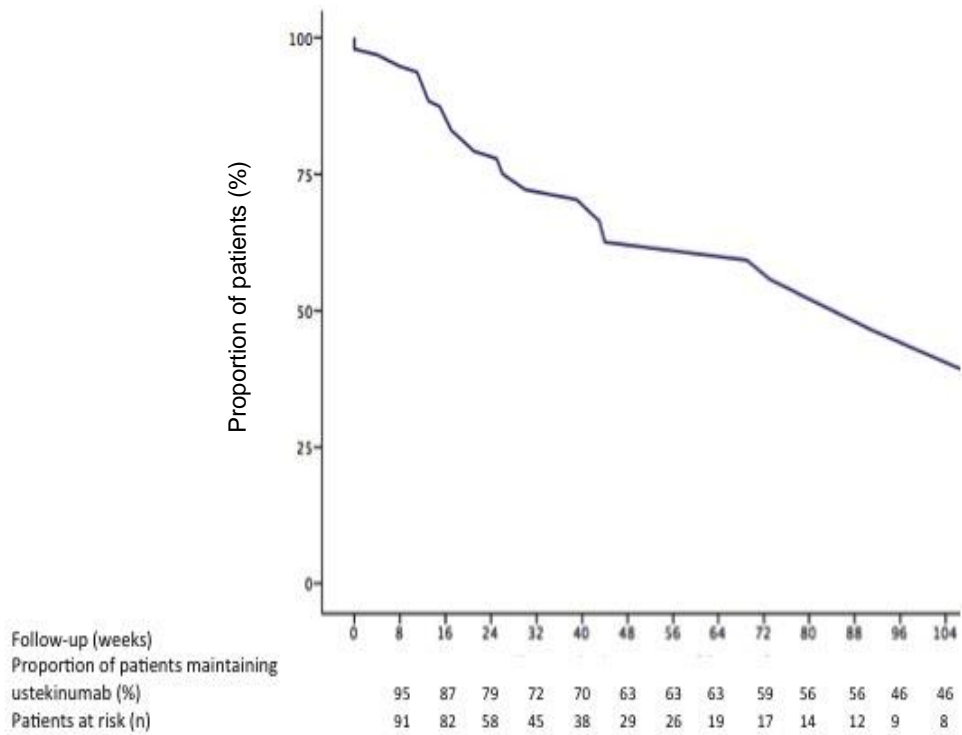
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Figure 1. Effectiveness of ustekinumab for the induction of clinical remission in ulcerative colitis (week 16).



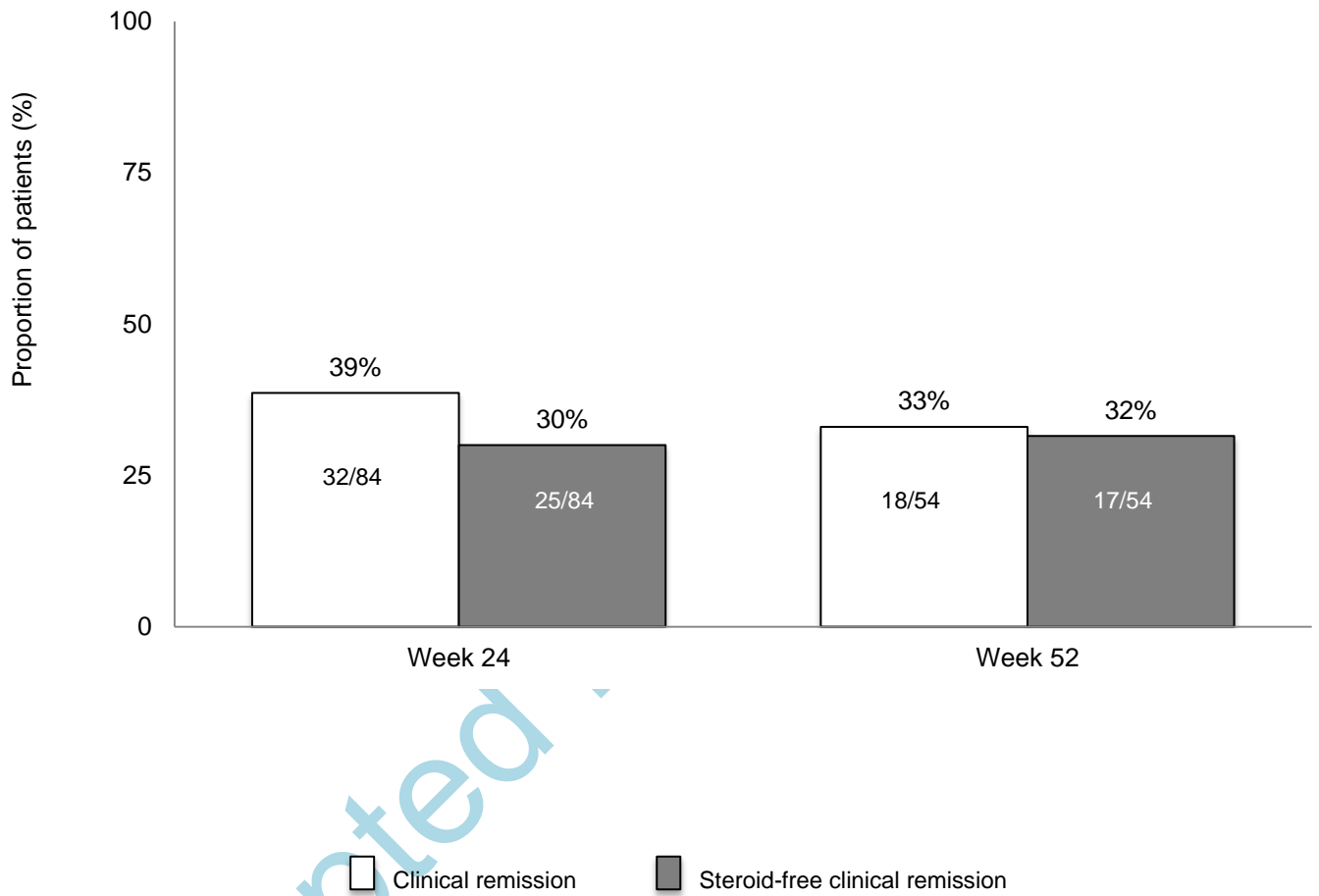
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Figure 2. Survival curve of the durability of ustekinumab treatment in patients with ulcerative colitis.



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Figure 3. Proportion of ulcerative colitis patients under ustekinumab treatment with clinical remission and steroid-free clinical remission at weeks 24 and 52.



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