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ECCO Guidelines on Therapeutics in Crohn's Disease:

Medical Treatment

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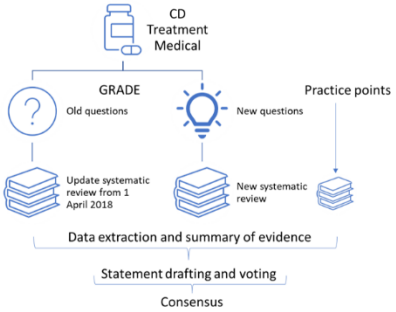
Graphical Abstract

The ECCO GRADE CD treatment guidelines were updated



We recommend a holistic approach to management of CD

GRADE statements on medical therapy

GRADE statements and practice points on nutritional therapy

Practice points on the role of the multidisciplinary team

We provide practical guidance on choice and optimisation of medical therapy

	Induction i	Maintenance i	Perianal disease ii	Peripheral Spondylo-arthropathy	Axial Spondylo-arthropathy	Pregnancy iii	Over 65 years
Systemic corticosteroids	iv			iv	iv	iv	iv
Enteral release corticosteroids						v	v
Enteral Nutrition							
Thiopurines monotherapy						vi	vii
Methotrexate							
Infliximab							
Adalimumab							
Certolizumab							
Vedolizumab							
Ustekinumab							
Risankizumab				viii	ix		
Upadacitinib			x	xi	xii		xiii

Recommended
Can be considered
Not recommended
Insufficient evidence

DRUGS SHOULD BE CONSIDERED BY MERIT, NOT SEQUENCED AS CONVENTIONAL TO ADVANCED

Drug selection should factor efficacy, safety, patient characteristics and preferences, disease characteristics and cost or access to therapies

GRADE statements and practice points on therapeutic drug monitoring, drug sequencing and combination, including ACT

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1. Introduction

Crohn's disease [CD] is a chronic inflammatory bowel disease [IBD] that can result in progressive bowel damage and disability.(1) CD can affect individuals of any age, from children to the elderly,(2, 3) and may cause significant morbidity and impact on quality of life [QoL]. The precise aetiology of CD remains unknown and a curative therapy is not yet available. Contemporary therapy therefore is focused on control of inflammation using medications along with timely surgical interventions to alleviate the symptoms of bowel damage.

The European Crohn's and Colitis Organisation [ECCO] produces several guidelines aimed at providing evidence-based guidance on critical aspects of IBD care. In 2020, ECCO published new guidelines on the management of CD in two manuscripts focused on the medical and surgical management of disease.(4, 5) For the 2020 CD guidelines, ECCO adopted the Grading of Recommendations Assessment, Development, and Evaluation [GRADE] approach, a systematic process for developing guidelines that addresses how to frame the healthcare questions, summarize the evidence, formulate the recommendations, and grade their strength and quality of associated evidence.(6) The present manuscript represents an update to the 2020 guidelines and is focused specifically on medical management of CD, whilst a companion manuscript developed as part of the same process addresses optimal surgical management.[Ed: cross-ref to surgical paper goes here] We take a drug-by-drug approach to review the evidence for various medical and dietary strategies used in the management of CD.

For this iteration of the guidelines, we have introduced several new clinically relevant questions as chosen by members of the guidelines group and a systematic approach to reviewing and updating previous topics to incorporate any new evidence and a reappraisal of all evidence in the context of contemporary practice. We have also introduced several 'practice points' to summarize evidence and expert recommendations in certain key areas of practice where the evidence base is limited but where clinicians and patients need to make decisions nonetheless. Here, where application of the GRADE methodology might be impractical, we have used an approach based on systematic literature review, expert discussion, and voting to form consensus recommendations outside of the formal GRADE process.

It is important to remember that achieving optimal outcomes in CD relies not just on knowledge of the appropriate use of current medical and surgical therapies but also on careful attention to wider aspects of management, including early diagnosis, prompt

initial management(7), close monitoring of treatment response, and psychological and dietary support.(8)

2. Methods

The development of these guidelines followed the GRADE workflow, as adopted in previous ECCO guidelines.(9) A panel of 46 experts were selected from an open call according to criteria based on IBD expertise, scientific background, knowledge of GRADE methodology, and prior contribution to ECCO projects. Additionally, six patients with CD selected by the European Federation of Crohn's and Colitis Associations [EFFCA] were invited to participate in discussions. The group was supported in their work by a team of professional methodologists and librarians.

The panellists first agreed on a list of questions using the Population, Intervention, Comparator, Outcomes [PICO] format. PICO questions addressed as part of the 2020 ECCO CD guidelines were reviewed and considered for retention due to ongoing relevance, whilst new PICO questions were formulated, discussed, and added to the list. The relevant outcomes for all PICO questions were graded according to importance using a Delphi consensus process. Note that for PICO questions retained from 2020, the importance of the outcomes was nonetheless revised according to the results of this new consensus.

The professional librarians next performed a comprehensive literature search on EMBASE, PubMed/Medline, and Cochrane Central databases using specific search strings developed for each PICO question [Supplementary Files available as Supplementary data at ECCO-JCC online]. For PICO questions retained from the 2020 guidelines, the same search string was used as during the prior literature search, and the start date of database queries set to the same as the end search date for the previous guidelines 1 April 2018. For all new PICO questions, the search start date was unlimited. Two independent consensus group members assessed the relevance of each abstract to the PICO and included or excluded all the relevant papers for the final data extraction and analysis. Subsequently, group members systematically reviewed and summarized the evidence on every outcome voted as 'important' or 'critical' to compile a Summary of Findings [SoF] table for each question or updated the prior SoF tables from 2020 [including revision according to any changes to outcomes deemed critical or important]. We adopted a standard hierarchical approach, searching for recent high-quality systematic reviews and meta-analyses of clinical trials to use in preference to individual randomized clinical trials [RCTs] or observational studies. Results of individual studies were pooled using random-effects meta-analysis as appropriate and when needed. The

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quality of evidence was then classified and used to inform draft recommendations according to the GRADE methodology.(6) GRADE evidence levels for safety data tended to be low due to downgrading for sparsity of events, reflecting the overall relative safety of the interventions under consideration. Therefore, whilst the evidence for all 'important' and 'critical' outcomes was considered in the drafting of a recommendation, we decided to base the overall assessment of evidence quality used to inform the strength of each recommendation upon the lowest quality of evidence obtained for the clinical or endoscopic outcomes for each PICO question. Where evidence was not available for an outcome of critical importance, this was reflected in the overall assessment of the quality of the evidence. The assessment of evidence for all individual outcomes was available to all panel members and is presented in the supplementary materials.

During initial discussions and based on feedback from previous ECCO guidelines, we recognized that in certain areas of CD management there are limited high-quality sources of evidence available, but that clinicians and patients must make decisions nonetheless. There are also broad, overarching themes relating to approaches to care that cannot be readily formulated into a PICO question. Use of the GRADE approach in these areas can be resource intensive and lead to recommendations of limited clinical utility. We therefore decided to frame a separate series of 'practice points' for such common areas of importance. For these, the systematic literature review and data extraction exercise was followed, and the findings used to inform drafting of an expert recommendation. We recognize that the resulting practice points are based upon a different level of evidence than the GRADE recommendations, but hope that they will be of practical use to readers nonetheless. These are clearly delineated in the text as distinct from GRADE recommendations.

All recommendations and practice points were subject to two rounds of online voting by the panel members, the ECCO National Representatives [two for each country affiliated with ECCO], and 37 additional reviewers from a list of ECCO members who applied to the open call but were not selected to be part of the Working Groups [see Acknowledgements section]. The pre-final versions of all recommendations and practice points were discussed among panel members during a series of final virtual consensus meetings before being put to a vote; final versions were approved only if at least 80% of the panellists agreed with the statement. The resulting statements and draft of this manuscript were critically reviewed by two external Guideline Committee members and by the ECCO Governing Board members, who also approved the final version of these Guidelines. Statements and practice points are ordered by drug, with statements

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concerning induction and maintenance therapy presented together where relevant. All statements should be read in the context of the supporting text that follows. A brief summary of the statements and text is presented at the start of each section of supporting text.

The literature search strategies, the relevant definitions of patient populations and outcomes, a detailed description of the process, and the SoF tables on the evidence can be found in the Supplementary Material, available as Supplementary data at ECCO-JCC online.

3. Medical management of CD

3.1 5-Aminosalicylates in the treatment of CD

5-Aminosalicylates for the induction of remission in CD

GRADE Statement 1.1: *We recommend against the use of 5-aminosalicylic acid for induction of remission of CD [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

5-Aminosalicylates for the maintenance of remission in CD

GRADE Statement 1.2: *We recommend against the use of oral 5-aminosalicylic acid as maintenance therapy in CD (strong recommendation, low-quality evidence). (Consensus: 100%)*

5-aminosalicylic acid has no role in contemporary management of CD, regardless of disease location, based on a consistent lack of evidence of efficacy.

There have been no new studies on 5-aminosalicylic acid [5-ASA] in induction of remission published since the previously published ECCO guidelines on therapeutics in CD.(4) A meta-analysis was performed by the ECCO working group on seven RCTs that compared induction therapy with oral mesalazine (10-14) or sulfasalazine(15, 16) with placebo in patients with active CD. 5-ASA doses of 1 to 3.2 g/day were for mild-to-moderate ileal, ileo-colonic, or colonic CD. There were similar clinical remission rates between 5-ASA therapy and placebo (relative risk [RR]: 1.28; 95% confidence interval [CI]: 0.97–1.69) and these data are consistent with other meta-analyses.(17) Adverse event [AE]-related treatment withdrawals were similar between treatment and placebo groups [RR: 1.13; 95% CI: 0.73–1.84].

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When excluding sulfasalazine trials, similar conclusions were reached for lack of benefit compared with placebo for induction of **clinical remission** [RR: 1.27; 95% CI: 0.79–2.03] and similar AE-related treatment withdrawal [RR: 1.0; 95% CI: 0.58–1.71]. Contradictory network meta-analysis data exist on the impact of higher dose [>2.4 g/day] mesalazine therapy on clinical remission.(18, 19) To assess for impact of delivery mechanism, pooled data from three trials for a slow-release preparation of mesalazine reported a significantly greater **reduction in the absolute value of the Crohn's Disease Activity Index** [CDAI] compared with placebo [weighted mean difference of 18 points]. However, the clinical significance of this difference is not meaningful.(20)

Data comparing sulfasalazine with placebo as **induction therapy in CD are derived from RCTs performed prior to 1985.** Pooled data showed borderline significantly higher clinical remission rates favouring sulfasalazine [RR: 1.38; 95% CI: 1.00–1.89] and similar AE-related treatment withdrawal rates between sulfasalazine and placebo [RR: 1.88; 95% CI: 0.65–5.47]. Importantly, analysis stratified by disease location showed sulfasalazine benefited only patients with colonic disease, whereas those with small-bowel involvement did not have higher clinical remission rates compared with placebo.(15, 16) There are no RCT data on the use of topical 5-ASA [enema or suppository] as induction therapy in CD.

Oral 5-ASA has been extensively studied for the maintenance of medically-induced remission in patients with CD. Overall, 11 placebo-controlled clinical trials assessed doses between 1 to 4 g per day.(21) Treatment durations varied between 4 and 36 months, with a 12-month evaluation most commonly assessed. No statistically significant benefit has been demonstrated for clinical outcomes with oral 5-ASA [risk ratio for relapse 0.98; 95% CI: 0.91–1.07]. No statistically significant benefit was demonstrated based on disease location, such as for patients with colonic-only involvement or with proctitis. However, given the relatively small nature of all the studies conducted in CD, none of the 11 placebo-controlled trials were adequately powered to assess efficacy in different sub-phenotypes. No significant differences were reported in AEs [RR: 1.05; 95% CI: 0.95-1.17] or serious adverse events [SAE] [RR: 1.43; 95% CI: 0.24–8.44] between 5-ASA and placebo. However, no definitive statements about safety can be made given the limited available safety data in CD [10 AEs in 1814 patients, and 3 SAEs in 576 patients].(21)

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3.2 Steroids in the treatment of CD

3.2.1 Locally acting steroids in the treatment of CD

Budesonide for the induction of remission in CD

GRADE Statement 2.1: *We recommend budesonide for the induction of clinical remission in patients with active mild-to-moderate CD limited to the ileum and/or ascending colon [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

Locally acting oral steroids are effective in induction of remission in CD and have a more favourable side-effect profile than systemic steroids. They have a role in induction of remission of mild-to-moderate CD but have no role as maintenance therapy.

A 2015 systematic review and meta-analysis(22) compared the efficacy and safety of induction therapy with budesonide to placebo. This analysis included three RCTs of patients with mild CD with disease location in the small intestine, ascending colon, or both.(23-25) Budesonide 9 mg was superior to placebo for inducing clinical remission [CDAI ≤ 150] at week 8 [RR: 1.93; 95% CI: 1.37–2.73]. In addition, withdrawals due to AEs [RR: 1.14; 95% CI: 0.46–2.79] and corticosteroid-related AEs [RR: 0.97; 95% CI: 0.76–1.23] were similar between budesonide 9 mg and placebo.(22) An updated meta-analysis in 2018 contained no new induction RCTs.(26)

Meta-analyses from 2015 and 2018 reviewed two RCTs(27, 28) comparing budesonide 9 mg daily with mesalazine <4.5 g daily for mild-to-moderate CD. Another RCT in 2018 also compared budesonide 9 mg daily to mesalazine 1 g three times daily in patients with mild CD and disease location in the small intestine, ascending colon, or both.(29) Budesonide had similar clinical remission [CDAI ≤ 150] rates at week 8 [RR: 1.30; 95% CI: 0.98–1.72] as compared with mesalazine. However, clinical response [decrease in CDAI ≥ 100 or total CDAI ≤ 150] rates were higher amongst budesonide-treated patients [RR: 1.22; 95% CI: 1.03–1.45]. Further data are needed regarding the impact of budesonide on mucosal healing.

AE [RR: 0.91; 95% CI: 0.79–1.05] and SAE [RR: 0.94; 95% CI: 0.24–3.75] rates were similar between budesonide and mesalazine-treated patients. Budesonide does not appear to be more effective than placebo for the maintenance of remission in CD.(30)

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3.1.2 Systemic corticosteroids in the treatment of CD

Systemic corticosteroids for the induction of remission in CD

GRADE Statement 2.2: *We suggest systemic corticosteroids can be used as induction therapy in patients with active, moderate-to-severe CD [weak recommendation, moderate-quality evidence]. (Consensus 100%)*

Although systemic steroids are effective in induction of remission in CD, they are associated with significant morbidity and mortality. Therefore, they should only be used as induction therapy when there is no alternative agent available for timely administration. Steroids should never be used as maintenance therapy.

The efficacy of systemic corticosteroids [oral methylprednisolone or oral prednisolone] compared with placebo for the treatment of moderately to severely active CD was assessed in two RCTs(15, 16). Data from these studies were synthesized in a Cochrane systematic review(15). Oral methylprednisolone was administered at a dose of 48 mg/day and tapered on a weekly basis to 32 mg, 24 mg, and 4 mg weekly thereafter to 12 mg, resulting in a 6-week induction period(15). Doses of oral prednisolone ranged from 0.50 to 0.75 mg/kg with a maximum daily dose of 60 mg, dependent on baseline CDAI. Induction lasted for 17 weeks with tapering to a dose of 0.25 mg/kg based on the CDAI(16).

One trial involving 105 patients reported on induction of clinical response(15). Clinical response was more common in patients receiving methylprednisolone compared with placebo [93.6% vs 53.4%, RR: 1.75; 95% CI: 1.36–2.25]. Corticosteroids were twice as effective in inducing clinical remission than placebo in the two studies(15, 16) involving 267 patients [RR: 1.99; 95% CI: 1.51–2.64].(31)

Data on AEs were available from one trial involving 162 patients treated with oral prednisolone(16, 32). The frequency of AEs was 5-fold higher in patients receiving corticosteroids compared with placebo [31.8% vs 6.5%, RR: 4.89; 95% CI: 1.98–12.07]. Steroid-related AEs included Cushing syndrome, acne, hirsutism, infection, ecchymoses, hypertension, diabetes mellitus, osteoporosis, cataracts, and glaucoma. A non-negligible proportion of patients experienced corticosteroid dependency or excessive exposure to these drugs, which is preventable.(33) In addition to the aforementioned AEs, there is substantial evidence on the association of corticosteroid use with increased incidence of infection(34) and death.(35, 36)

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Imprecision associated with a low number of events for all efficacy and safety outcomes led to the downgrading of evidence to moderate quality. The availability of induction agents with a more favourable risk-benefit profile led to the recommendation being classed as 'weak'. Clinicians should seek to minimize steroid usage in their practice. In instances where steroids are used, the need for more than a single course of corticosteroids in 1 year or the presence of corticosteroid dependency [the inability to taper and stop steroids without a clinical flare or relapse] should warrant a steroid-sparing strategy.

3.3 Immunomodulators in the treatment of CD

3.3.1 Thiopurines in the treatment of CD

Thiopurines for the induction of remission in CD

GRADE Statement 3.1: *We recommend against the use of thiopurine monotherapy as induction therapy for CD [strong recommendation, very low-quality evidence]. (Consensus: 100%)*

Thiopurines for the maintenance of remission in CD

GRADE Statement 3.2: *We suggest thiopurine monotherapy can be used as maintenance therapy in CD [weak recommendation, low-quality evidence]. (Consensus: 95%)*

Thiopurines may be effective in maintenance of remission in CD after induction has been achieved by other means, but clinicians should consider their side-effect profile and the availability of other therapies.

Several studies have evaluated thiopurines compared with placebo for induction of remission and response in CD;(37-44) the data have been synthesized in a Cochrane systematic review.(45) Five trials evaluated thiopurines for induction of clinical remission [12–17 weeks] in comparison with placebo; four used azathioprine(37-39, 42) and one mercaptopurine.(41) The trials differed in the definition of remission and the time of endpoint assessment, and most allowed concomitant corticosteroids [except for (37)]. There was no significant difference in clinical remission compared with placebo (48% [95/197] vs 37% [68/183], RR: 1.23; 95% CI: 0.97–1.55).

Three trials reported clinical response using non-standardized disease activity measures based on physician assessment.(40, 43, 44) There was no significant difference

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compared with placebo (42.9% [12/28] vs 26.9% [7/26], RR: 1.87; 95% CI: 0.44–7.96]). Heterogeneity and sparse data led to downgrading the quality of evidence to very low.

A single trial reported on AEs during induction(42) with no significant difference between thiopurines and placebo (69% [36/52] vs 86% [24/28], RR: 0.81; 95% CI: 0.64–1.02]). SAEs were reported in two trials;(37, 42) 13.5% of those receiving AZA versus 3.8% of those receiving placebo developed SAEs [pooled RR: 2.57; 95% CI: 0.92–7.13]. The quality of evidence was deemed low due to a very low number of events [n = 19] and wide confidence intervals. In conjunction with ample data supporting the delayed onset of action of thiopurines,(46) a strong recommendation against thiopurine use as induction therapy was made despite the very low quality of evidence.

When considering thiopurines as maintenance therapy, one meta-analysis consisting of six studies [489 participants] reported the efficacy and safety in patients with steroid-dependent CD [and thus was judged to provide indirect evidence in patients without steroid dependency].(47) Azathioprine [1.0–2.5 mg/kg/day] was significantly superior to placebo for maintaining clinical remission over a 6–18 month period [73% vs 62%, RR: 1.19; 95% CI: 1.05-1.34].(47) This meta-analysis also demonstrated that a significantly higher proportion of azathioprine-treated patients [9%] withdrew due to AEs compared with placebo [2%, RR: 3.12; 95% CI: 1.59–6.09] and experienced more SAEs [azathioprine 9% vs placebo 3%, RR: 2.45; 95% CI: 1.22–4.90]. The most prevalent AEs included pancreatitis, leukopenia, nausea, allergic reactions, and infections.(47) The frequent dose-limiting hematopoietic toxicity that is seen in thiopurine-treated patients can be decreased by thiopurine methyltransferase analysis [enzymatic activity or genotype] prior to commencing thiopurine therapy. Loss-of-function variants of the nucleoside diphosphate linked moiety X [Nudix]-type motif 15 [NUDT15] genotype, common in Asian populations, also predispose to myelosuppression and can also be analysed prior to treatment initiation.(48, 49) Large cohort studies have also suggested limited efficacy as maintenance therapy in CD.(50)

A nationwide French cohort study confirmed an increased adjusted hazard ratio [HR] for serious infections [HR: 1.32; 95% CI: 1.23–1.42] in thiopurine-treated patients when compared with unexposed patients.(51) Patients on thiopurines are at increased risk for lymphoproliferative disorders and myeloproliferative disorders, with older patients and those without a previous Epstein-Barr virus infection at highest risk.(52) A systematic review and meta-analysis [4 studies] on the risk of lymphoma in patients exposed to thiopurine monotherapy versus patients unexposed to anti-TNF agents or thiopurines demonstrated that the pooled incidence rate [IRR] of lymphoma was 2.23 [95% CI:

1.79–2.79].(53) Patients on thiopurine monotherapy are also at an increased risk of non-melanoma skin cancer [NMSC] and may have an increased risk of cervical high-grade dysplasia and cancer.(52)

The SONIC trial showed thiopurine monotherapy to be inferior to infliximab monotherapy or combination therapy.(54) Along with the lack of efficacy in induction and the adverse safety profile, this limits the use of thiopurines as maintenance therapy and is reflected in the weak recommendation given by the consensus group.

3.3.2 Methotrexate in the treatment of CD

Methotrexate for the induction of remission in CD

GRADE Statement 4.1: *We suggest parenteral methotrexate can be used as induction therapy in moderate-to-severe CD (weak recommendation, moderate-quality evidence). (Consensus: 94%)*

Methotrexate for the maintenance of remission in CD

GRADE Statement 4.2: *We suggest parenteral methotrexate monotherapy can be used as maintenance therapy in moderate-to-severe CD [weak recommendation, low-quality evidence] (Consensus: 97%)*

Parenteral methotrexate may be effective in the treatment of CD, whilst studies of oral methotrexate have failed to demonstrate efficacy.

In the single eligible placebo-controlled RCT,(55) 141 steroid-dependent patients with active CD were randomized to either 25 mg/week of intramuscular methotrexate or placebo for 16 weeks, with a concomitant daily dose of prednisone [20 mg at initiation] that was tapered over 10 weeks. At week 16, a significantly larger proportion of patients treated with methotrexate were in clinical remission than with placebo (39% [37/94] vs 19% [9/47], RR: 2.06; 95% CI: 1.09–3.89]). The rate of treatment discontinuation for AEs [mainly elevated liver enzymes and nausea] was significantly higher when compared with placebo (17% [16/94] versus 2% [1/47], RR: 8.00; 95% CI: 1.09–58.51). The effect size estimates for remission are imprecise and the results may be confounded by the concomitant use of corticosteroids. There were no studies comparing methotrexate without concurrent steroid use with placebo for the induction of remission, resulting in indirectness of evidence when considering patients without steroid dependency.

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Two further studies evaluated the efficacy of oral methotrexate at lower doses [12.5 mg weekly or 15 mg weekly](56, 57) compared with placebo in steroid-dependent patients with CD and found no significant difference for induction of clinical remission.

Methotrexate may be considered as an option for steroid-dependent patients when alternative options [including surgery] cannot be used. The teratogenicity of the drug must be considered and patients counselled appropriately.(9) Retrospective data suggest that methotrexate has some efficacy in peripheral arthritis in IBD.(58)

Evidence on the use of parenterally administered methotrexate as maintenance therapy is derived from a single double-blind, placebo-controlled RCT where patients with steroid-dependent CD were administered weekly intramuscular injections of 15 mg methotrexate or placebo for 40 weeks. Patients with previously active CD who had entered remission after 16–24 weeks of treatment with 25 mg methotrexate given intramuscularly once weekly were randomly assigned to receive either methotrexate 15 mg intramuscularly once weekly or placebo for 40 weeks. No other treatments for CD were permitted. After 40 weeks, the proportion of patients who remained in clinical remission was higher in the methotrexate group [65% vs 39%, RR: 1.67; 95% CI: 1.05–2.67).(59) No differences in SAEs were observed, although nausea and vomiting occurred numerically more frequently among patients in the methotrexate group [40% vs 25%]. Patients treated with methotrexate may be at increased risk of NMSC, as demonstrated in a single nested, case-control study (odds ratio [OR]: 8.55; 95%: CI 2.55–31.8).(60) However, other studies exploring NMSC in patients with IBD failed to demonstrate such an association.(52, 61, 62) Low-dose oral methotrexate [12.5–15 mg/week] as monotherapy does not appear to be effective for maintenance of remission in CD.(63)

3.4 TNFα antagonists in treatment of CD

3.4.1 Infliximab in the treatment of CD

Infliximab monotherapy for the induction of remission in CD

GRADE Statement 5.1: *We recommend infliximab as induction therapy with moderate-to-severe active CD [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

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Infliximab monotherapy for the maintenance of remission in CD

GRADE Statement 5.2: *We recommend infliximab as maintenance therapy in moderate-to-severe CD [strong recommendation, low-quality evidence]. (Consensus: 100%)*

Infliximab combination therapy for the induction of remission in CD

GRADE Statement 5.3: *We recommend combination therapy with a thiopurine when starting infliximab as induction therapy in patients with moderate-to-severe CD [strong recommendation, moderate-quality evidence] (Consensus: 100%)*

Infliximab combination therapy for the maintenance of remission in CD

GRADE Statement 5.4: *We recommend combination therapy with infliximab and thiopurines for a minimum of 6–12 months when using infliximab as maintenance therapy in patients with CD (strong recommendation, moderate-quality evidence). (Consensus: 100%)*

Withdrawal of immunomodulator in patients with long-term remission when using infliximab to treat CD

GRADE Statement 5.5: *In patients with CD who have achieved long-term remission with the combination of anti-TNF and thiopurines, we suggest de-escalation to anti-TNF monotherapy and withdraw thiopurines [weak recommendation, moderate-quality evidence]. (Consensus: 100%)*

Infliximab is effective for the induction and maintenance of remission in CD. Combination therapy used during induction and for the first 6–12 months can improve efficacy and reduce immunogenicity; data to support this practice are largely derived from studies evaluating combination with a thiopurine. Once long-term remission has been established, the immunomodulator can be withdrawn in most patients, although caution may be exercised in patients with prior immunogenicity to an anti-TNF.

Infliximab is monoclonal antibody targeting TNFα that is administered intravenously [IV] at a dose of 5 mg/kg at 0, 2, and 6 weeks during induction and every 8 weeks thereafter when continued IV. The efficacy of infliximab monotherapy for induction therapy in patients with active CD was evaluated in one small [n = 108] randomized placebo-controlled trial comparing a single infusion of infliximab 5 mg/kg [n = 27], 10 mg/kg [n = 28], or 20 mg/kg [n = 28] with placebo [n = 25]. In this trial, standard dosing of

infliximab [5 mg/kg] was superior to placebo for inducing clinical response at week 12 [RR: 4.01; 95% CI: 1.29–12.44]. Superiority of infliximab was not observed for clinical remission at week 12 [RR: 3.70; 95% CI: 0.87-15.80]. Endoscopic endpoints were not reported. Although safety was evaluated in this study, AEs were pooled for all dosing schemes of infliximab, precluding any conclusion on the safety profile of standard dosing of infliximab, with the level of certainty further impacted by sparse data.(64) Following the pivotal trial of Targan et al., the ACCENT I trial established the induction dosing timepoints of week 0 followed by week 2 and week 6(65).

No separate meta-analysis has focused primarily on the outcomes of infliximab maintenance therapy in patients with CD. Two landmark RCTs were published more than 20 years ago, and were pooled for the purpose of this guideline.(65, 66) In total, 408 patients who clinically responded to one dose of infliximab [CDAI decrease ≥70] were included. After 44 weeks, the overall likelihood of achieving clinical remission with infliximab (5 or 10 mg/kg every 8 weeks) over placebo was 2.15 [95% CI: 1.52–3.05]. Mucosal healing [defined as absence of mucosal ulceration] was assessed at 54 weeks in one RCT,(67) showing superiority of infliximab over placebo [RR: 7.00; 95% CI: 1.02–48.10]. However, patients in the placebo group received episodic doses of infliximab.

In the pivotal trials, AEs [RR: 0.97; 95% CI: 0.88–1.07], SAEs [RR: 0.86; 95% CI: 0.65–1.14], and serious infections [RR: 0.85; 95% CI: 0.36–2.00] were not different between infliximab and placebo.(65, 66) In a network analysis performed in the framework of a Cochrane collaboration, the dose-adjusted OR for severe AEs for infliximab was 1.13 [95% CI: 0.79–1.62].(68) Evidence for clinical and endoscopic outcomes for infliximab maintenance therapy was downgraded due to imprecision [sparse events] and indirectness [since the 10 mg/kg dose is higher than the standard maintenance dose of 5 mg/kg] in the two pivotal RCTs. This led to an overall assessment of the level of evidence as low. Nevertheless, consensus participants decided to make a strong recommendation for use in maintenance therapy based on extensive real-world experience relating to efficacy and safety of standard dosing, and the widespread availability of infliximab as biosimilars with relatively low acquisition costs.

The SONIC RCT(54) compared the efficacy of infliximab combined with azathioprine over infliximab monotherapy in patients naïve to both therapies who failed to respond to steroids or 5-ASA. Combination therapy resulted in higher rates of clinical remission at week 26 when compared with infliximab monotherapy [RR: 1.64; 95% CI: 1.07–2.53]. Combination therapy was also more likely to result in mucosal healing at this timepoint [RR: 1.82; 95% CI: 1.01–3.26]. There were significantly lower rates of SAEs in those receiving combination therapy [RR: 0.56; 95% CI: 0.32–0.97](54), with no difference in

total AEs. In addition, several prospective(69) and retrospective observational studies(70-72) and a network meta-analysis have also suggested the benefit of combination therapy with azathioprine over infliximab monotherapy.(73) Combination therapy with azathioprine appears to improve efficacy by enhancing pharmacokinetic features of infliximab.(74)

For patients who achieved clinical remission after induction with combination therapy with infliximab and immunomodulator, two RCTs provide data on combination therapy versus monotherapy within the maintenance period; these are the SONIC trial(54) for combination of infliximab with azathioprine and the COMMIT trial(75) for combination of infliximab with methotrexate. Meta-analysis of these data revealed higher rates of mucosal healing [RR: 1.46; 95% CI: 1.00–2.13] and improved patient-reported outcomes, measured as change in Inflammatory Bowel Disease Questionnaire [IBDQ] score from baseline [Mean difference [MD]: 4.8; 95% CI: 2.23–11.83]. Although resulting in numerically higher efficacy rates, combination therapy was not superior in clinical response [RR: 1.21; 95% CI: 0.96–1.53], clinical remission [RR: 1.25; 95% CI: 0.97–1.61], or steroid-free clinical remission [RR: 1.15; 95% CI: 0.85–1.55]. SAEs were less frequent with combination therapy [RR: 0.66; 95% CI: 0.41–0.98], whereas total AEs [RR: 1.01; 95% CI: 0.94–1.09] were similar between groups.

More recently, infliximab has been licensed for subcutaneous [SC] maintenance administration after IV induction dosing. This decision was based on pharmacokinetic and safety data comparing maintenance SC dosing every 2 weeks with IV dosing.(76) Subsequent RCT data have demonstrated the superiority of maintenance SC infliximab versus placebo for clinical and endoscopic endpoints amongst responders to IV infliximab induction therapy, demonstrating that this formulation is an effective option for responders to IV induction.(77) Multiple cohort studies have reported the effectiveness and safety of switching patients already established on standard doses of IV maintenance infliximab to SC maintenance dosing.(78) Future recommendations on infliximab combination therapy may change with emerging evidence on the efficacy, pharmacokinetics, and immunogenicity of SC infliximab.(79)

The combination of anti-TNF therapy with a thiopurine is associated with adverse long-term safety signals both in terms of risk of serious infection and malignancy.(51, 52) This raises questions regarding potential de-escalation of treatment for patients in stable remission. The recent SPARE trial investigated clinical relapse in CD patients in steroid-free clinical remission for a minimum 8 months under combined infliximab and immunomodulator therapy who either continued combination therapy or stopped infliximab or immunosuppressive therapy.(80) In this study with 211 randomized CD

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patients, clinical remission was significantly more often maintained over 2 years of follow up when combination therapy was de-escalated to infliximab monotherapy [63/69; 91%] when compared with immunomodulator monotherapy [46/71; 65%] [RR: 1.41; 95% CI: 1.17-1.7]. There were no significant differences in clinical relapse rates, endoscopic outcomes, or pharmacokinetic outcomes between the group continuing combination therapy and those discontinuing immunomodulator therapy. AEs occurred at a similar frequency across treatment groups.

In general, a higher risk of lymphoma exists when anti-TNF agents are combined with conventional immunosuppression, although the absolute rates remain very low and are estimated at 1.9 per 10 000 patient-years in a meta-analysis consisting of almost 9000 patients included in the SEER database.(81) In clinical practice, the decision to de-escalate should be discussed individually with the patient and risk factors for disease progression and residual disease activity should be considered. Finally, in patients with immunogenic failure towards a first anti-TNF agent, the addition of thiopurines during switch to a second anti-TNF agent increases efficacy and reduces immunogenicity.(82) In these patients, evaluation of thiopurine discontinuation should be done with special caution, with de-escalation considered predominantly in patients without prior immunogenicity.

3.4.2 Adalimumab in the treatment of CD

Adalimumab monotherapy for the induction of remission in CD

GRADE Statement 6.1: *We recommend adalimumab as induction therapy in patients with moderate-to-severe CD [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

Adalimumab monotherapy for the maintenance of remission in CD

GRADE Statement 6.2: *We recommend adalimumab monotherapy as maintenance therapy in moderate-to-severe CD [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

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Adalimumab combination therapy for the induction of remission in CD

GRADE Statement 6.3: *We suggest adalimumab monotherapy should be used over combination therapy with thiopurines as induction therapy in patients with moderate-to-severe CD naïve to biologics [weak recommendation, moderate-quality evidence]. (Consensus: 100%)*

Adalimumab combination therapy for the maintenance of remission in CD

GRADE Statement 6.4: *We suggest adalimumab monotherapy should be used over combination with an immunomodulator as maintenance therapy in patients with moderate-to-severe CD naïve to biologics [weak recommendation, low-quality evidence] (Consensus: 98%)*

Adalimumab is effective for the induction and maintenance of remission in CD. Available evidence does not support combination with an immunomodulator in biologic-naïve patients, although combination therapy may be considered in patients with prior immunogenicity to an alternative anti-TNF.

Adalimumab is a fully humanized IgG1 monoclonal antibody directed against TNFα approved for the treatment of moderate-to-severe CD. Adalimumab is administered SC at a dose of 160 mg and then 80 mg 2 weeks after induction, followed by 40 mg SC every 2 weeks. A meta-analysis of pooled data on adalimumab versus placebo from three RCTs(83-85) involving 680 patients with moderate-to-severe CD who did not achieve adequate response or were intolerant to corticosteroids and/or immunosuppressants demonstrated efficacy for induction of clinical remission [RR: 3.58; 95% CI: 2.42–5.29] and clinical response [RR: 1.98; 95% CI: 1.47–2.67] within 4 weeks of therapy initiation. Limited endoscopic data were available for the induction period only in one study; the data showed a significant trend towards enhanced mucosal healing [RR: 30.51; 95% CI: 1.87–498.81]. However, this evidence was downgraded due to high imprecision arising from sparse data(86). There was no difference in AEs between those receiving adalimumab or placebo during the induction period [RR: 0.91; 95% CI: 0.75–1.11].(83-85) Rates of SAEs with adalimumab were also not significantly different from placebo [RR: 0.29; 95% CI: 0.09–0.96], but evidence was downgraded due to imprecision from sparse data.(83-85) Data revealed improved QoL based on the IBDQ within 4 weeks of therapy initiation[RR: 0.91; 95% CI: 0.75–1.11]. A Cochrane review based on three RCTs revealed similar results for clinical remission, response, improvement in QoL, and AEs during the first 4 weeks of therapy.(87)

Data from three RCTs in individuals with moderate-to-severe CD who responded to induction therapy [CHARM, EXTEND 1, CLASSIC-II] demonstrated efficacy of adalimumab 40 mg SC every 2 weeks over placebo for maintenance of clinical remission [RR: 2.70; 95% CI: 1.75–4.19] at 52–56 weeks of follow up.(86, 88, 89) Outcomes of clinical response [RR: 2.01; 95% CI: 1.14–3.55], but not corticosteroid-free remission [RR: 2.32; 95% CI: 0.62-8.63], were also improved with adalimumab.(88, 89) RCT data on endoscopic outcomes are more limited, but suggest efficacy of adalimumab relative to placebo in endoscopic remission [RR: 9.14; 95% CI 2.21–37.80], endoscopic response [RR: 14.22; 95% CI: 1.93–104.98], and mucosal healing [RR: 31.00; 95% CI: 1.90–506.95].(86) Based on a post-hoc analysis of a single placebo-controlled trial, QoL improvement was greater with adalimumab [RR: 1.32; 95% CI: 1.11–1.62].(90)

Regarding safety during the maintenance period, pooled clinical trial data indicated that adalimumab was associated with fewer SAEs than placebo [RR: 0.57; 95% CI: 0.39–0.83], while any AE [RR: 1.00; 95% CI: 0.86–1.15] and serious infections were comparable [RR: 0.79; 95% CI: 0.34–1.79].(86, 88, 89) In a network analysis performed in the framework of a Cochrane collaboration, the dose-adjusted OR for SAEs for adalimumab was 1.01 [95% CI: 0.64–1.59].(68)

Only one open-label RCT [the DIAMOND trial](91) studied the use of combination therapy of adalimumab with a thiopurine when compared with adalimumab monotherapy for the induction of clinical remission in patients naïve to both therapies. In this trial, combination therapy was not superior to adalimumab monotherapy for inducing clinical remission at week 26 [primary endpoint] [RR: 0.95; 95% CI: 0.78–1.15]. However, combination therapy was associated with endoscopic improvement at week 26 [RR: 1.32; 95% CI: 1.06–1.65], although this benefit was lost by week 52. There was no increase in AEs leading to discontinuation associated with combination therapy [RR: 1.03; 95% CI: 0.60–1.78].

The week 52 maintenance outcomes of the DIAMOND trial demonstrated no clinical benefit of combination therapy in clinical remission [RR: 1.07; 95% CI: 0.91-1.25], clinical response [RR: 0.95; 95% CI: 0.78–1.15],(91, 92) steroid-free clinical remission [RR: 0.97; 95% CI: 0.85–1.12],(92) endoscopic response [RR: 1.20; 95% CI: 0.89–1.62],(93) mucosal healing [RR: 1.77; 95% CI: 0.82–3.82],(93) SAEs [RR: 0.25; 95% CI: 0.01–5.00], or any AE [RR: 0.81; 95% CI: 0.47–1.38].(91, 92) Likewise, a meta-analysis that included retrospective studies also revealed that combination therapy was not superior to monotherapy for maintenance of remission [OR: 1.08; 95% CI: 0.79–1.48, p = 0.48].(94) More recently, post-hoc analysis of 6 RCTs [CLASSIC-I, GAIN, CHARM, EXTEND, ULTRA 1, and ULTRA 2] demonstrated no efficacy benefits with

immunomodulator and adalimumab combination therapy when compared with adalimumab monotherapy in CD patients with inadequate disease control on immunomodulatory therapy.(95)

The DIAMOND study included patients naïve to adalimumab. In the case of immune-mediated loss of response to a first anti-TNF, RCT evidence suggests that combination therapy is of benefit with the second anti-TNF.(82) Additionally, the observational PANTS study demonstrated a significant reduction in anti-adalimumab antibody development with adalimumab combination therapy in anti-TNF naïve patients [HR: 0.44; 95% CI: 0.31–0.61],(69) suggesting that some patients may benefit from combination therapy with adalimumab and a thiopurine depending on genetic predisposition.(96) Therefore, combining adalimumab with an immunomodulator should be considered in high-risk groups, including those with prior immunogenic failure to other anti-TNFs.

3.4.3 Certolizumab in the treatment of CD

Certolizumab for the induction of remission in CD

GRADE Statement 7.1: *We suggest certolizumab can be used as induction therapy in patients with moderate-to-severe CD [weak recommendation, moderate-quality evidence]. (Consensus: 97%)*

Certolizumab for the maintenance of remission in CD

GRADE Statement 7.2: *We suggest certolizumab can be used as maintenance therapy in moderate-to-severe CD [weak recommendation, moderate-quality evidence]. (Consensus: 100%)*

Certolizumab may be an effective treatment for the induction and maintenance of remission in CD. Availability varies between regions; it is not approved by the European Medicines Agency.

Certolizumab pegol (herein termed certolizumab) is a humanized polyethylene glycol (PEG)ylated F(ab) fragment of a monoclonal antibody directed against TNFα. Although certolizumab is not approved by the European Medicines Agency (European Union) for the treatment of CD, it is commercially available elsewhere, including in Switzerland and Russia. The efficacy and safety of certolizumab for induction therapy in patients with moderately to severely active CD was evaluated in four randomized placebo-controlled trials including a total of 1485 patients.(97-99) A Cochrane review from 2019 evaluated the efficacy and safety of certolizumab as induction therapy for CD.(100) Certolizumab

was superior to placebo for induction of clinical response [RR: 1.29; 95% CI: 1.09–1.53] and clinical remission [RR: 1.36; 95% CI: 1.11–1.66]. Endoscopic outcomes were not reported. The rates of any SAEs [RR: 1.35; 95% CI: 0.93–1.97] were not different between certolizumab and placebo.

Two RCTs assessed the efficacy and safety of certolizumab as maintenance therapy [400 mg every 4 weeks] in patients with moderate-to-severe CD [Precise I and II](98, 101). A total of 1088 patients [30% had previous infliximab failure] were included and followed for only 26 weeks. Compared with placebo, certolizumab maintained a higher clinical response rate [reduction ≥100 points from baseline CDAI, OR: 1.64; 95% CI: 1.38–1.95] and resulted in greater rates of clinical remission [CDAI score ≤150 points, OR: 1.55; 95% CI: 1.23–1.95]. Furthermore, QoL as assessed by a minimum 16-point increase in the IBDQ from baseline showed a significant improvement in patients treated with certolizumab, with a relative effect of 1.35 [95% CI: 1.17–1.55]. Endoscopic outcomes were not measured. The incidence of SAEs did not differ significantly between patients treated with certolizumab and those who received placebo, with a relative effect of 1.19 [95% CI: 0.70–2.02]. In a network analysis performed in the framework of a Cochrane collaboration, the dose-adjusted OR for severe AEs for certolizumab was 1.57 [95% CI: 0.96–2.57].(68)

The reporting of all maintenance endpoints at the early timepoints of week 26 resulted in downgrading the evidence quality of clinical maintenance endpoints. When combined with the absence of endoscopic endpoints, the consensus group decided that the strength of recommendation should be weak. Consistent with the weak recommendation for certolizumab as a maintenance therapy, and the widespread availability and suitability of other anti-TNF therapies, including biosimilar options, the consensus group agreed that the recommendation for use of certolizumab as induction therapy should also be weak.

3.4.4 Drug monitoring when using anti-TNF therapy

Proactive and reactive drug monitoring compared with standard of care

GRADE Statement 8.1: *There is insufficient evidence to recommend the use of proactive therapeutic drug monitoring compared with reactive therapeutic drug monitoring or standard of care when using anti-TNF agents [weak recommendation, very low-quality evidence]. (Consensus: 100%)*

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Practice Point 1: *Therapeutic drug monitoring may be used when optimizing dose in patients with CD treated with anti-TNF therapy (Consensus: 94%)*

The use of therapeutic drug monitoring for anti-TNF therapy was evaluated with both a GRADE evaluation and development of a practice point. GRADE evaluation of trial data did not demonstrate superiority of proactive drug monitoring compared with reactive monitoring or no drug monitoring when considering our predefined GRADE outcomes. However, further assessment of the literature during development of the practice point highlighted several ways in which therapeutic drug monitoring can be useful when optimizing dose of anti-TNF therapy, which is reflected in widespread use in clinical practice as discussed in the text.

Numerous prospective studies and post-hoc analysis of RCTs have shown that higher anti-TNF drug concentrations during maintenance therapy are associated with higher rates of favourable therapeutic outcomes in patients with CD.(102) Low drug concentrations are also associated with primary non-response [PNR], loss of response [LOR], and development of anti-drug antibodies.(69) A key question is whether dose optimization in clinical practice based on prospective measurement of drug levels [proactive therapeutic drug monitoring, or TDM] can confer clinical benefit.

Pooled data from RCTs showed no statistically significant difference between proactive TDM and standard-of-care anti-TNF therapy in clinical remission [three studies, RR: 1.12; 95% CI: 0.90–1.39], steroid-free clinical remission [three studies, RR: 1.00; 95% CI: 0.77–1.31], endoscopic remission [two studies, RR: 0.96; 95% CI: 0.72–1.27], biochemical remission [two studies, RR: 1.08; 95% CI: 0.87–1.33], SAEs [two studies, RR: 1.27; 95% CI: 0.76–2.14], or serious infections [two studies, RR: 1.47; 95% CI: 0.10–21.20].(103-107) However, these RCTs had some important methodological issues regarding study design, including a rather low cut-off drug concentration for dose escalation, heterogeneity of study populations, and the fact that proactive TDM did not start early during induction.

In a recent systematic review and meta-analysis, there was no significant difference in the risk of failing to maintain clinical remission in patients who underwent proactive TDM versus clinically driven dose adjustments in patients with CD treated with anti-TNF therapy [RR: 0.87; 95% CI: 0.66-1.15].(108) Similarly, another meta-analysis showed no superiority of proactive TDM compared with conventional management in maintaining clinical remission with anti-TNF agents [RR: 1.16; 95% CI: 0.98–1.37].(109) On this

basis, there was insufficient evidence to recommend the use of proactive therapeutic monitoring for patients with CD undergoing treatment with anti-TNF therapy.

However, the consensus group noted that there was evidence for additional important outcomes outside the remit of our voted GRADE outcomes that may confer benefit to the patient. A meta-analysis including both retrospective studies and RCTs found that proactive TDM of anti-TNF therapy was associated with a significantly decreased risk of treatment failure compared with either standard of care [RR: 0.64; 95% CI: 0.48–0.85] or reactive TDM [RR: 0.46; 95% CI: 0.21–0.98]. Moreover, proactive TDM was associated with a significant reduction in hospitalization [RR: 0.33; 95% CI: 0.21–0.54].(110) These findings were replicated in another meta-analysis that also highlighted potential cost efficiency of proactive TDM.(109)

Proactive TDM may also be useful in other clinical scenarios, such as anti-TNF therapy de-escalation,(111) restarting infliximab following a pause in scheduled drug administration, and optimizing infliximab monotherapy when combination therapy with an immunomodulator is not possible due to patient preference or high risk of SAEs.(112) Recent data from two studies including mainly patients with CD suggest that proactive TDM can also mitigate risk of immunogenicity to anti-TNF therapy and treatment cessation in patients with a positive HLA-DQA1*05 genotype, previously found to predispose to development of anti-drug antibodies against infliximab and adalimumab.(96, 113, 114)

Data from paediatric studies were not included in the GRADE analysis. However, cumulative evidence from RCTs suggests that proactive TDM of anti-TNF therapy is associated with better outcomes compared with clinically-based dosing or reactive TDM in CD in paediatric populations.(115, 116) In particular, the PAILOT RCT including children with CD naïve to biological therapy who responded to adalimumab induction therapy showed that sustained corticosteroid-free clinical remission was significantly higher in the proactive compared with the reactive TDM arm [82% vs 48%; respectively $p = 0.002$].(115) Moreover, a recent RCT on a biologic-naïve paediatric population with CD that responded to infliximab induction therapy showed that proactive TDM compared with clinically based dosing was superior regarding sustained corticosteroid-free clinical remission [89.5% vs 70.9%, $p = 0.025$] and endoscopic healing [85% vs 57.1%, $p = 0.025$].(116)

Reactive TDM, defined as the evaluation of drug concentrations and antidrug antibody titres when PNR or LOR occur, may help identify the mechanisms underlying these undesirable outcomes, which in turn may shape future drug selection.(117)

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Observational study data suggest that this may be a cost-effective strategy associated with potential for better therapeutic outcomes.(118-120)

Consequently, whilst recognizing the problems with the evidence base reflected in the GRADE statement, the consensus group recognizes a place for TDM in clinical care, when available. Nonetheless, several problems concerning TDM for anti-TNF therapy remain, including identification of optimal drug concentration targets, assay variability, and feasibility of timely dosing interventions. Importantly, although there is some evidence of dose-response relationships for non-anti-TNF biologics in CD, there is much less evidence to suggest a potential benefit for TDM-guided dosing, and use of TDM in the routine care of patients treated with non-anti-TNF biologics is not supported.(121, 122)

3.5 IL-12/IL-23 inhibitors in the treatment of CD

3.5.1 Ustekinumab in the treatment of CD

Ustekinumab for the induction of remission in CD

GRADE Statement 9.1: *We recommend ustekinumab as induction therapy in moderate-to-severe CD [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

Ustekinumab for the maintenance of remission in CD

GRADE Statement 9.2: *We recommend ustekinumab as maintenance therapy in moderate-to-severe CD [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

Ustekinumab is effective for the induction and maintenance of remission in CD.

Ustekinumab is an IgG1 monoclonal antibody that binds to the p40 subunit shared by the pro-inflammatory interleukins 12 and 23. In CD, induction is given IV using a weight-based regimen of approximately 6 mg/kg. One systematic review and meta-analysis pooled the results from RCTs in which ustekinumab was compared with placebo for **induction of remission** in adult patients with moderately to severely active luminal CD.(123) Four trials(124-127) involving 1947 patients treated with different ustekinumab IV doses or equivalent placebo reported on **induction outcomes** at 6 weeks. Data were extracted and a meta-analysis was performed, demonstrating efficacy in clinical response [RR: 1.56; 95% CI: 1.38–1.57] and clinical remission [RR: 1.76; 95% CI: 1.40–2.22]. Two substudies(126, 128) involving 252 patients revealed that more patients receiving ustekinumab achieved endoscopic improvement compared with

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placebo [47.7% vs 29.9%, RR: 1.60; 95% CI: 1.13–2.26] and a reduction in the mean global histology activity scores [from 10.4±7.0 to 7.1±5.9; $p < 0.001$] at 8 weeks. A more recent RCT(129) investigating the efficacy and safety of guselkumab in CD, in which ustekinumab was administered in a reference arm [63 patients] reported similar results at 12 weeks. Two studies(130, 131) reported on the effect of ustekinumab on health-related QoL. The RR was 2.42 [95% CI: 1.27–4.61] for achieving PRO-2 remission, 2.14 [95% CI: 1.27–3.62] for IBDQ remission, and 1.86 [95% CI: 1.33–2.59] for IBDQ response at 12 weeks.(129) Similarly, significantly greater proportions of patients receiving ustekinumab had clinically meaningful IBDQ and SF-36 score improvement at 8 weeks compared with placebo in a pooled analysis of two pivotal RCTs. One study reported pooled safety results of phase 2/3 RCTs on any **AEs** or S**AEs** after induction [1653 patients].(130) The pooled RR of **any AEs** was not significantly different between ustekinumab and placebo [53.8% vs 56.1%, RR: 0.96; 95% CI: 0.89–1.03]. Similarly, the pooled RR of any **SAEs** and of any serious infection were not significantly different between ustekinumab and placebo [4.5% vs 6.2%, RR: 0.72; 95% CI: 0.51–1.02 and 1.1% vs 1.2%, RR: 0.95; 95% CI: 0.45–2.01, respectively]. The rate of antidrug antibody formation was <5%.(132) Finally, a meta-analysis(133) of 63 observational studies [8529 patients] reported that 60% [95% CI: 54–67%, I^2 = 93%] of patients who received ustekinumab achieved clinical response, 37% [95% CI: 28-46%, I^2 = 97%] achieved clinical remission, and 33% [95% CI: 27–40%, I^2 = 86%] achieved corticosteroid-free clinical remission at 8–14 weeks, replicating the results of RCTs in a real-world setting of refractory patients with CD.

Maintenance outcomes were also evaluated. One RCT included patients with moderate-to-severe CD who responded to ustekinumab induction therapy. Patients were re-randomized to receive ustekinumab 90 mg [either every 8 weeks or every 12 weeks] or placebo. More patients receiving ustekinumab when compared with those receiving placebo were in clinical remission over a 44-week follow up [51% vs 35.9%, RR: 1.42; 95% CI: 1.10–1.84](125), and at week 56 [50.2% vs 27.7%; RR: 1.83; 95% CI: 1.35–2.47].(132, 134) The same study showed that more patients receiving ustekinumab were also in corticosteroid-free clinical remission over a 44-week follow up [44.7% vs 29.8%, RR: 1.50; 95% CI: 1.12–2.02] and after 56 weeks of treatment [44.7% vs 22.1%; RR: 2.02; 95% CI: 1.43–2.86](125, 132, 134). Similar results were shown for clinical response. There are limited placebo-controlled trial data from a subgroup analysis on endoscopic remission [total SES-CD score ≤2] and mucosal healing [complete absence of any mucosal ulcerations among patients who presented with ulceration in at least one ileocolonic segment at induction]. There was no statistically significant difference in mucosal healing [RR: 3.13; 95% CI: 0.40–24.53] or endoscopic

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remission [RR: 2.61; 95% CI: 0.32–21.08] between ustekinumab and placebo.(126) Nevertheless, outcome data from a large randomized trial comparing treatment with ustekinumab every 8 weeks with adalimumab every 2 weeks showed similar endoscopic outcomes between the two groups.(135) In addition, post-hoc analyses showed that ustekinumab improved health-related QoL compared with placebo.(130) A pooled safety analysis from phase 2/3 studies showed that there was no statistically significant difference between placebo- or ustekinumab-treated patients for SAEs [RR: 1.03; 95% CI: 0.85–1.26] and serious infections [RR: 1.57; 95% CI: 0.98–2.51] for a mean follow up of 48 weeks.(131)

3.5.2 Ustekinumab compared with adalimumab for induction of remission in CD

GRADE Statement 10.1: *We suggest adalimumab or ustekinumab are equally as effective as induction therapy in biologic-naïve patients with moderate-to-severe CD [weak recommendation, moderate-quality evidence]. (Consensus: 100%)*

Ustekinumab compared with adalimumab for maintenance of remission in CD

GRADE Statement 10.2: *We suggest adalimumab and ustekinumab are equally as effective as maintenance therapy in biologic-naïve patients with moderate-to-severe CD [weak recommendation, moderate-quality evidence]. (Consensus: 100%)*

RCT evidence suggests that ustekinumab and adalimumab may be equally effective for the induction and maintenance of remission in CD in patients without prior biologic exposure.

The SEAVUE trial (phase 3b)(135) was an active comparator randomized trial that used a 'treat-through' design to compare the effectiveness and safety of ustekinumab and adalimumab monotherapy in biologic-naïve adult patients with moderately to severely active CD. Of note, the threshold of endoscopic disease required for trial inclusion was lower compared with several other studies [requiring at least one, single ulcer of any size]. The primary endpoint was the proportion of patients in clinical remission [CDAI score <150] at week 52. Three-hundred eighty-six patients were enrolled and randomly assigned to receive ustekinumab [n = 191] or adalimumab [n = 195]. Ustekinumab induction was approximately 6 mg/kg IV on day 0, followed by maintenance of 90 mg SC at week 8 and then 90 mg SC once every 8 weeks. Adalimumab induction was 160 mg SC on day 0, 80 mg SC at week 2, followed by maintenance of 40 mg SC at week 4 and then once every 2 weeks. Study treatments were administered as monotherapy and

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without dose modifications. Both monotherapies were effective for induction of remission at week 16 [ustekinumab 57% vs adalimumab 60%, difference −3%, 95% CI: −13 to 7; nominal p = 0.55] and demonstrated comparative efficacy [RR: 0.95; 95% CI: 0.80–1.13]. Response rates at 16 weeks were similar between agents [72% vs 73%, respectively], with moderate-quality evidence. Safety outcomes for both groups did not show significant differences.

When considering maintenance outcomes at week 52, 64.9% [124/191] of patients receiving ustekinumab every 8 weeks versus 61.0% [119/195] of patients receiving adalimumab every 2 weeks were in clinical remission [RR: 1.06; 95% CI: 0.91-1.24].(135) Similarly, corticosteroid-free clinical remission was achieved in 61% of the ustekinumab group and 57% of the adalimumab group [RR: 1.06; 95% CI: 0.90–1.25]. Both treatment groups showed similar endoscopic response [ustekinumab 42% vs adalimumab 37%, RR: 1.14; 95% CI; 0.88–1.47] and endoscopic remission rates [ustekinumab 29% vs adalimumab 31%, RR: 0.93, 95% CI: 0.67–1.28] at week 52.(135)

Overall, the safety profile was similar between groups for AEs [RR: 1.03; 95% CI 0.93–1.14] and SAEs [RR: 0.82; 95% CI 0.22–3.00]. However, the numeric proportions of patients in the ustekinumab group [34%] that experienced infections was lower than in the adalimumab group [41%], although rates of serious infections were similar.(135)

Overall, the consensus group noted that data from this single RCT suggested similar efficacy and safety outcomes, with moderate evidence quality. Nonetheless, the study used doses of drugs that did not entirely align with licensed doses within Europe and dose escalation was not permitted. The findings may not apply to patients with previous biologic therapy failure or longer disease history. Furthermore, longer-term follow up beyond 1 year would be required to determine if efficacy and safety are sustained similarly with each drug. Overall, this led to a decision to make a weak recommendation, reflecting the strength of the evidence and these additional concerns.

3.5.3 Risankizumab in the treatment of CD

Risankizumab for the induction of remission in CD

***GRADE Statement 11.1**: We recommend risankizumab as induction therapy in moderate-to-severe CD [strong recommendation, high-quality evidence]. (Consensus: 100%)*

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Risankizumab for the maintenance of remission in CD

GRADE Statement 11.2: *We recommend risankizumab as maintenance therapy in moderate-to-severe CD [strong recommendation; high-quality evidence] (Consensus: 100%)*

Risankizumab is effective for the induction and maintenance of remission in CD.

Risankizumab is a humanized, monoclonal IgG1 class antibody that binds to the p19 subunit of IL-23. Two placebo-controlled RCTs were identified.(136) The two studies included a total of 889 patients with moderately to severely active CD with evaluable outcome data after exposure to either three IV doses of 600 mg risankizumab [weeks 0, 4, and 8] or placebo, with primary outcome measures captured at week 12. Clinical response and clinical remission were achieved more often in patients receiving risankizumab compared with placebo [RR: 1.79; 95% CI: 1.47-2.17 and RR: 1.95; 95% CI:1.57–2.43, respectively]. Endoscopic response and endoscopic remission were achieved with risankizumab more often than placebo [RR: 2.96; 95% CI: 2.17–4.05 and RR: 3.22; 95% CI: 1.93–5.38, respectively]. Rates of any AEs in patients treated with risankizumab occurred statistically less often than in patients receiving placebo [RR: 0.85; 95% CI: 0.62–1.17]. SAEs and serious infections occurred less often in risankizumab-treated patients [RR: 0.45; 95% CI: 0.3–0.67 and RR: 0.21; 95% CI: 0.07–0.65, respectively].

Clinical responders to risankizumab from the two phase 3 induction trials were re-randomized in a single maintenance therapy trial. One-hundred forty-one evaluable participants received 360 mg risankizumab SC every 8 weeks, whilst 164 participants received SC placebo.(137) Compared with placebo, more patients treated with risankizumab achieved clinical remission [51.8% vs 39.6%, RR: 1.31; 95% CI: 1.02–1.67] or endoscopic response [46.8% vs 22.0%, RR: 2.13; 95% CI: 1.52-2.99] at week 52.(137, 138) A higher proportion of patients on risankizumab maintenance also achieved clinical response, endoscopic remission, and ulcer-free endoscopy after 1 year of therapy. The overall incidence of any SAEs or serious infections were similar across study groups.

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3.6 Anti-integrin therapies in the treatment of CD

3.6.1 Vedolizumab in the treatment of CD

Vedolizumab for the induction of remission in CD

GRADE Statement 12.1: *We recommend vedolizumab as induction therapy in moderate-to-severe CD [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

Vedolizumab for the maintenance of remission in CD

GRADE Statement 12.2: *We recommend vedolizumab as maintenance therapy in moderate-to-severe CD [strong recommendation, moderate-quality evidence]. (Consensus: 100%)*

Vedolizumab is effective for the induction and maintenance of remission in CD.

Vedolizumab is a monoclonal IgG1 antibody that acts by blocking the α4β7 integrin, resulting in disruption of lymphocyte trafficking and anti-inflammatory activity. It is administered IV at a fixed dose of 300 mg at 0, 2, and 6 weeks for induction. Patients who do not achieve response at week 6 can benefit from an additional administration at week 10.(139) Four RCTs involving 1126 patients treated with vedolizumab or placebo reported on **clinical and** safety outcomes in adult patients with moderately to severely active luminal CD at 6–10 weeks.(140-143) Data were extracted and a meta-analysis was performed. Vedolizumab was superior to placebo in induction of clinical response [RR: 1.59; 95% CI: 1.32–1.91] and clinical remission [RR: 2.00; 95% CI: 1.51–2.66]. Endoscopic outcome data were not assessed. The pooled RR of **any AEs** was not significantly different between vedolizumab and placebo [62% vs 53.8%, RR: 1.15; 95% CI: 0.88–1.51]. Similarly, the pooled RR of **SAEs** was not significantly different between vedolizumab and placebo [9.0% vs 9.2%, RR: 0.99; 95% CI: 0.68–1.44].

A meta-analysis(144) of 74 observational studies [13 663 patients] reported that 56% [95% CI: 51–61%; I^2 = 89%] of the patients who received vedolizumab exhibited clinical response, 36% [95% CI: 32–40%, I^2 = 85%] achieved clinical remission, 30% [95% CI: 25–34%, I^2 = 87%] achieved corticosteroid-free clinical remission, and 29% [95% CI: 19–42%, I^2 = 58%] achieved mucosal healing at 6–16 weeks, replicating the results of RCTs in a real-world setting of refractory patients with CD.

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Maintenance therapy with vedolizumab was investigated in three RCTs in patients with moderate-to-severe CD who had responded to induction therapy. Vedolizumab was administered IV at 300 mg every 8 weeks in two studies(140, 143) and SC at 108mg every 2 weeks in one study.(145) Following 52–60 weeks of maintenance therapy, vedolizumab was superior to placebo in achieving clinical remission [RR: 1.55; 95% CI: 1.25–1.91], with 44.7% [197/441] of patients receiving vedolizumab in clinical remission when compared with 27.1% [81/299] of patients receiving placebo. Moreover, vedolizumab was effective at maintaining steroid-free clinical remission [RR: 2.23; 95% CI: 1.44–3.44]; this endpoint was achieved in 39.0% [71/182] of patients receiving vedolizumab compared with 16.3% [21/129] of patients receiving placebo. Again, no endoscopic data were generated during the registrational trials, although endoscopic outcomes have been collected during open-label clinical trials and cohort studies.(146) Vedolizumab showed a similar incidence of AEs [RR: 0.96; 95% CI: 0.86–1.08], SAEs [RR: 0.98; 95% CI: 0.67–1.44], and serious infections [RR: 0.32; 95% CI: 0.09–1.13] compared with placebo through week 52–60. Similar safety signals were observed in the GEMINI long-term safety study that followed CD patients exposed to IV vedolizumab every 4 weeks for a median of 32 months [range 0.03–100.3].(147)

3.7 Janus kinase inhibitors in the treatment of CD

3.7.1 Upadacitinib in the treatment of CD

Upadacitinib for the induction of remission in CD

GRADE Statement 13.1: *We recommend upadacitinib as induction therapy in moderate-to-severe CD [strong recommendation; high-quality evidence]. (Consensus: 100%)*

Upadacitinib for the maintenance of remission in CD

GRADE Statement 13.2: *We recommend upadacitinib as maintenance therapy in moderate-to-severe CD [strong recommendation; moderate-quality evidence]. (Consensus: 100%)*

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Upadacitinib is the only JAK inhibitor recommended for the induction and maintenance of remission in CD.

Upadacitinib is an oral Janus kinase [JAK] inhibitor with relatively increased selectivity for JAK-1. Two RCTs (148) reported outcomes for a total 1021 patients that were randomized in a 2:1 ratio to receive either 45 mg/day of upadacitinib or placebo for 12 weeks. We meta-analysed outcomes from these trials. A significantly higher percentage of patients receiving upadacitinib achieved clinical remission than those who received placebo [44.4% vs 25.1%, $p < 0.001$] and endoscopic response [40.2% vs 8.4%, $p < 0.001$). Significantly higher proportions of patients on upadacitinib achieved clinical response, steroid-free remission, and endoscopic remission when compared with placebo. The overall incidence of safety outcomes was similar between patients exposed to upadacitinib and placebo.

Clinical responders from the induction RCTs were re-randomized to receive daily upadacitinib 15 mg [n = 169], upadacitinib 30 mg [n = 168], or placebo [n = 165].(149) When compared with placebo, maintenance therapy with upadacitinib 15 mg once daily and 30 mg once daily by week 52 resulted in significantly higher rates of clinical remission [37.3% and 47.6% vs 15.1%, respectively, $p < 0.001$ for both comparisons], endoscopic response [35.5% and 40.1% vs 7.3%, respectively, $p < 0.001$ for both], and remission [19.1% and 28.6% vs 5.5%, respectively, $p < 0.001$ for both].

A higher proportion of patients on upadacitinib maintenance achieved clinical response and steroid-free clinical remission with improved QoL. Efficacy outcomes were all numerically higher in the group receiving higher doses of maintenance therapy, although this should be viewed against safety and cost considerations. The overall incidence of any SAEs or serious infections were similar across study groups. Herpes zoster infection was reported in 4.0% of patients receiving maintenance treatment with 15 mg upadacitinib and 7.2% of patients receiving 30 mg upadacitinib, compared with 4.7% in the placebo group. No adjudicated cardiovascular events were reported. One case of hepatic vein thrombosis concurrent with exacerbation of CD was reported in a patient receiving 30 mg upadacitinib.

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3.8 Nutritional therapy in the treatment of CD

3.8.1 Exclusive Enteral Nutrition for the induction of remission in CD

GRADE Statement 14.1: *We suggest Exclusive Enteral Nutrition can be used as induction therapy in patients with mild-to-moderate CD who are motivated to adhere to dietary therapy, have access to dietetic support, and prefer to avoid corticosteroids. [Weak recommendation, very low-quality evidence] (Consensus: 100%)*

Exclusive Enteral Nutrition (EEN) is suggested for induction of remission in CD. A meta-analysis of available data for adult patients demonstrated inferiority to steroids in intention-to-treat analysis; however, similar rates of induction of remission were found when restricting analysis to patients who were able to adhere to therapy. As steroid use is associated with high morbidity, we suggest EEN as an alternative to steroids in motivated patients with appropriate dietetic support.

EEN is a therapeutic approach involving the consumption of a liquid medical formula as the sole food source, usually for 6–8 weeks. In children with luminal mildly to moderately active CD, EEN is the first-line therapy for inducing clinical remission according to ECCO-ESPGHAN guidelines, with data showing superiority over corticosteroids in achieving mucosal healing.(150) In adults, several studies show that in patients who are able to tolerate the diet, EEN can be effective for induction of remission,(151) even in complicated diseases,(152) and as preoperative optimization therapy.(153) An age subgroup analysis [>18] conducted in the most recent Cochrane review, including six trials with very low-quality evidence, indicated that 45% [87/194] of EEN patients achieved remission compared with 73% [116/158] of patients treated with corticosteroids [RR: 0.65; 95% CI: 0.52–0.82].(151) However, a per-protocol analysis did not reveal a significant difference in inducing remission between EEN and corticosteroids. This suggests that the disparity in the success of EEN between children and adults is primarily attributed to compliance. AE rates did not significantly differ between EEN and corticosteroids during the trial period, although milder AEs were reported with EEN.

Consequently, where clinicians and patients wish to attempt use of EEN as a therapeutic alternative to corticosteroids for induction of remission in CD, it is important to focus on strategies to enhance compliance and improve palatability. The effectiveness of EEN does not appear to be influenced by the type of formula, including protein [elemental, semi-elemental, and polymeric] and fat composition or method of administration

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[nasogastric or oral].(151) Utilizing EEN effectively requires a multidisciplinary team [MDT], with dietitian support playing a pivotal role.(154)

3.8.2 Dietary therapies in the management of CD

Dietary therapy for the induction of remission in CD

Practice Point 2A: *There is emerging evidence that dietary therapies may be beneficial in reducing the inflammatory burden in CD. However, currently no universally applicable diet will benefit all patients with CD. Dietary intervention should primarily be considered based on disease activity, the patient's motivation, the current evidence, and the availability of dietetic support. All patients with CD should have access to dietary services, especially during disease flare. (Consensus: 97%)*

Dietary therapy for the maintenance of remission in CD

Practice Point 2B: *Partial Enteral Nutrition might be considered as a strategy for maintaining remission, with or without additional medication, in a subset of patients who are willing and able to tolerate the formula with routine monitoring. (Consensus: 100%)*

Recently, food-based diets have gained attention as a potential adjunct or monotherapy for reducing inflammation in active CD, offering a more palatable alternative to EEN.(155) The Crohn's Disease Exclusion Diet [CDED] is currently the most studied approach with accumulating supportive data for its use in adult patients with CD.(156-158) A recent pilot RCT involving adult patients with active mild-to-moderate disease showed that CDED, either alone or in combination with partial enteral nutrition [PEN] as monotherapy, resulted in a 62% remission rate at week 6, with 50% of patients maintaining remission up to week 24 and 35% achieving endoscopic remission.(158) Based on the currently available evidence, the recent ESPEN guidelines recommended considering using CDED as an alternative to EEN in adults with mild-to-moderate CD.(159)

Another noteworthy study investigated the Specific Carbohydrate Diet [SCD] alongside the Mediterranean diet as an adjunct to licensed medical therapy. Both diets exhibited approximately 40% symptomatic remission rates, with no significant difference observed. Consequently, the authors concluded that the Mediterranean diet, given its ease of adherence, should be preferred over SCD.(160) An additional diet derivative from the SCD is the IBD anti-inflammatory diet, with one case series in IBD showing an improvement in Harvey-Bradshaw Index [HBI] and potential as an adjunct dietary therapy with ongoing studies.(161-163)

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Additional interventions, such as CD-TREAT, aim to replicate EEN's nutritional composition and effects on the intestinal microbiota, with ongoing studies in adults exploring efficacy with promising preliminary data.(164) Lastly, the low fermentable oligosaccharides, disaccharides, monosaccharides, and polyols [FODMAP] diet has shown promise in alleviating intestinal symptoms without significant impact on inflammation. Therefore, the low FODMAP diet is recommended primarily for patients with quiescent CD experiencing functional symptoms.(165)

Numerous studies, particularly within the Japanese population, suggest that PEN may be effective as a long-term strategy to maintain remission. In a meta-analysis including eight studies, patients receiving PEN [420–1800 kcal/d] had a significantly lower clinical relapse rate [RR: 0.67; 95% CI: 0.54–0.82, $p < 0.01$] over 0.5 to 2 years compared with those not receiving nutritional therapy. The authors concluded that PEN may be more effective than the absence of enteral nutrition therapy for the maintenance of remission in CD with a good safety profile.(166) Another meta-analysis showed that adding PEN to infliximab led to 74.5% remission at one year compared with 49.2% using infliximab alone [OR: 2.93, $p < 0.01$](167). The use of PEN for maintenance of remission was suggested as a treatment option to prolong remission by the paediatric ECCO-ESPGHAN guidelines in the case of low-risk patients.(150)

3.9 Sequencing and combination of therapies in CD

3.9.1 Sequencing of advanced therapies in CD

Practice Point 3: *There is currently insufficient evidence to direct how advanced therapies should be positioned in a therapeutic algorithm for luminal CD. Decisions should consider efficacy, safety, patient preferences and characteristics, disease characteristics, and cost or access to therapies. (Consensus: 97%)*

Positioning of therapies in CD is one of the main challenges in daily clinical practice. This is particularly true of agents commonly termed advanced therapies; biological therapies and targeted small molecules. All approved drugs can be effective for patients with CD, but data enabling direct comparison between drugs are largely absent. Limited head-to-head RCT data exist, such as the SEAVUE trial, which compared adalimumab and ustekinumab in CD(135) and the SEQUENCE trial, which compared risankizumab and ustekinumab.(168) Even with these large and well conducted RCTs, it is important to consider that they apply to specific comparisons made in specific populations. For example, in SEAVUE, the finding of broadly comparable efficacy between ustekinumab

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and adalimumab relates to the treatment of patients without prior biologic exposure and without the option of dose escalation. Likewise, the SEQUENCE trial, presented in abstract form only during the preparation of these guidelines, showed significantly higher rates of response and remission for clinical and endoscopic outcomes in patients treated in an open-label manner with risankizumab over those treated with ustekinumab, specifically amongst a population of patients with failure of prior anti-TNF therapy.(168, 169)

Even with other head-to-head RCTs in progress, there will still be insufficient direct evidence to address many questions that arise in routine clinical practice. In this context, clinicians can and should try to make treatment recommendations based upon understanding of the available evidence. This includes the consideration as to what extent evidence from populations that differ slightly from the patient under consideration may be used to inform decision making for the individual patient. Clinicians may also wish to consider indirect comparisons based on network meta-analyses.(170-172) However, it is important to note that these are sensitive to differences between trial populations, definitions and timing of outcome measures, and in the design of maintenance studies. Cohort studies can provide complementary evidence on real-world populations, often including groups that might otherwise be excluded from clinical trials, with use of statistical methodologies to correct for baseline differences in measured confounders.(72) These studies should be considered alongside assessment of potential sources of bias, unmeasured confounding factors, and difficulties inherent in the lack of randomization. Additionally, understanding of safety data may be improved with analysis of similar data that may be available for patients exposed to a drug for a different licensed indication, although again, clinicians should consider to what extent the risk profile of the external population matches the patient under consideration.

Ultimately, whilst it is not appropriate to form firm conclusions from indirect methodologies such as network meta-analyses or large cohort studies, taken in isolation, these can provide valuable insight. Where alternative sources of indirect evidence are discrepant, it is not possible to form clear predictions of relative drug performance. When the findings are congruent, this may provide some confidence in the application of the results to clinical practice.

Given the potential for uncertainty in many of these comparisons, it is also important to understand the factors important in decision making for an individual patient. Different patients may apply different priority to, for example, efficacy, safety, or other aspects of the therapeutic profile. Clinicians should also consider disease-related factors [such as perianal disease and extraintestinal manifestations(58)] and patient-related factors

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[such as comorbidity, including concurrent immune-mediated disorders, age, desire to become pregnant, and susceptibility to infection], all of which may have implications for the risk-benefit profile of any given therapy. Finally, short-term, long-term, direct, and indirect costs should be considered in the decision process, which may differ from region to region. We have summarized the situations in which specific therapies may be beneficial in CD [Figure 1].

Figure 1: medical therapy in the management of CD

	Induction i	Maintenance i	Perianal disease ii	Peripheral Spondylo-arthropathy	Axial Spondylo-arthropathy	Pregnancy iii	Over 65 years
Systemic corticosteroids	iv			iv	iv	iv	iv
Enteral release corticosteroids						v	v
Enteral Nutrition							
Thiopurines monotherapy						vi	vii
Methotrexate							
Infliximab							
Adalimumab							
Certolizumab							
Vedolizumab							
Ustekinumab							
Risankizumab				viii	ix		
Upadacitinib			x	xi	xii		xiii

Recommended
Can be considered
Not recommended
Insufficient evidence

i. This figure summarises a complex area with limitations to much of the available data, it is not intended to replace individualised decision making. Please see the main text of these guidelines for discussion of the evidence base; recommendations and considerations are derived from GRADE recommendations and suggestions respectively for induction and maintenance outcomes

ii. Recommendations on the medical management of perianal disease are adapted from the CD Treatment Guideline surgical manuscript (ref)

iii. Recommendations on the safe medical management of CD during pregnancy are taken from the ECCO guidelines on sexuality, fertility, pregnancy and lactation(9), with strength of recommendation aligned to the GRADE recommendations of this guideline

iv. Systemic corticosteroids should only be used if there are no available alternatives, especially in patients over the age of 65, or as a bridge to the initiation of an effective maintenance therapy.

v. Enterally acting corticosteroids can only be considered as induction agents in pregnancy and in the over 65s, and are not recommended for maintenance of remission

vi. Thiopurines can be continued as maintenance therapy in pregnancy, but should not be newly started as monotherapy nor used as induction agents(9)

vii. Can be considered case by case if there are no available alternatives

viii. Inferred from positive trial data in psoriatic arthritis(173-175)

ix. Inferred from negative trial data in axial spondyloarthritis(176)

x. Upadacitinib may represent a therapeutic alternative in patients with prior anti-TNF failure, intolerance or contraindications. This is based upon post-hoc analysis of RCT data showing a significant benefit over placebo across a range of relevant fistula endpoints (177)

xi. Inferred from positive trial data in psoriatic arthritis (178)

xii. Inferred from positive trial data in axial spondyloarthritis (179)

xiii. EMA recommend reserving for when no alternatives are available in patients over the age of 65

3.9.2 Advanced combination therapies in treatment of CD

Practice Point 4: *Advanced combination therapy may be necessary when there are uncontrolled extraintestinal manifestations or symptomatic immune-mediated disorders needing more than one agent to achieve remission. Advanced combination therapy may also be an option for refractory CD. There is currently no evidence to support advanced combination therapy in patients naïve to advanced therapies, even in high-risk patients. (Consensus: 100%)*

Despite important progress in therapy for CD, up to 60% of patients fail to achieve long-term remission.(180) Advanced combination therapy [ACT] refers to the combination of biologic agents, targeted small molecules, or both, and can be considered for the following three different settings: uncontrolled extraintestinal manifestations, patients with concomitant immune-mediated diseases, and patients with a refractory IBD phenotype where no surgical options are feasible.(181) When considering refractory disease, it is reasonable to combine agents that have resulted at least in a partial response before without adverse side effects. When ACT is aimed at controlling extraintestinal manifestations or immune-medicated diseases, the preferred combination should be based on the specific clinical setting, including any prior evidence of partial response to a particular agent, availability of evidence suggesting potential efficacy from other relevant indications, and safety considerations. While targeting more than one mechanistic pathway in patients naïve to advanced therapies may make sense, especially if the underlying biology is better characterized, there is currently no evidence to support ACT upfront, even in patients judged to be at high-risk of disease progression or complications.

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Evidence on ACT in IBD is mostly retrospective with limited quality, and has recently been gathered in two systematic reviews with meta-analyses that include studies reporting on outcomes in both UC and CD.(180, 182) Table 1 summarizes the single RCT and the cohorts that have reported outcomes with ACT specifically for CD patients. The use of ACT for CD was the focus of the phase 4 single-arm EXPLORER trial (NCT02764762), which was designed to investigate the safety and efficacy of the combination of vedolizumab, adalimumab, and methotrexate in patients newly diagnosed with CD with the presence of features predictive of an increased risk of disease complications. There was no comparator arm, although post-hoc Bayesian analysis suggested a high degree of probability that the combination treatment was more effective than benchmark estimates for the efficacy of adalimumab or vedolizumab monotherapy.(183) Ongoing RCTs of ACT, including a trial of guselkumab with golimumab [NCT05242471] may improve understanding of potential efficacy and safety.

Author [year]	**Study Design**	**Population**	**Outcomes**	**Combination** [n exposed]	**Safety**	**Efficacy**	**Notes**
Sands [2007](184)	Randomized controlled trial	79 adult patients with active CD despite infliximab	Safety, tolerability Clinical remission, quality of life; CRP	Infliximab + natalizumab [52] Infliximab + placebo [27]	AEs reported in 48/52 vs 17/27 SAEs reported in 1/52 vs 1/27	CDAI decrease [38 vs 3.5 points; p = 0.085]	Steroids, antibiotics, and immunomodulators allowed

Cost-effectiveness analyses will be important prior to any more widespread adoption of these approaches.

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Yang [2020](185)	Retrospective Cohort	22 adult patients with refractory CD [with total of 24 different ACT exposures]	Endoscopic improvement Endoscopic remission, clinical response, clinical remission, CRP	Vedolizumab + ustekinumab [8] Vedolizumab + anti-TNF [13] Ustekinumab + anti TNF [3]	AEs in 3/24 trials [13%]	Endoscopic improvement [43%] Endoscopic remission [26%] Clinical response [50%] Clinical remission [41%] Steroid-free clinical remission [36%] Significant CRP decline [17 to 9 mg/dL, p = 0.02]	Assessment at 32 weeks
Lee [2020](186)	Retrospective cohort	19 adult patients with CD	Clinical response Clinical remission Endoscopic response Endoscopic remission Biochemical remission AEs SAEs	Tofacitinib + ustekinumab [11/19] Tofacitinib + vedolizumab [7/19] Tofacitinib + certolizumab [1/19]	0/19 SAEs 7/19 AEs	8/19 clinical response 6/19 clinical remission 2/19 endoscopic response 2/19 endoscopic remission 3/19 biochemical remission	3/19 patients added the second treatment for pyoderma gangrenosum 16/19 added the second treatment for CD Assessment between weeks 30 and 36 Steroids and methotrexate allowed
Colombel [2022](183)	Open-label clinical trial Interim analysis	55 biologic-naïve adult patients with moderate-to- severe newly diagnosed CD [prior 24 months] at high risk of complications	Endoscopic remission Clinical remission AEs SAEs	Vedolizumab + adalimumab + methotrexate	48/55 AEs 6/55 SAEs	19/55 endoscopic remission 34/55 clinical remission	Assessment at week 26

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CDAI, Crohn's disease activity index; CRP, C-reactive protein

1. Table 1. Available evidence for Advanced combined therapy CD

3.10 Optimization of the delivery of care in the treatment of CD

3.10.1 The role of the MDT and governance around decision making in the treatment of CD

Practice Point 5: *We recommend involvement of a MDT in clinical management and joint decision making in managing care of patients with CD. (Consensus: 97%)*

Healthcare organizations and clinicians should be continuously improving and safeguarding the quality of care. Shared decision making [SDM] practiced by MDT members is fundamental to attaining this goal and delivering patient-centred care. Data from two systematic reviews [62 and 28 manuscripts, respectively, number of patients not stated] suggested that using an integrated care model and MDT consisting of healthcare professionals across specialties [e.g. gastroenterologists, IBD nurses, colorectal surgeons, psychologists or counsellors, dietitians, radiologists, pathologists, pharmacists] achieved the most effective management of IBD. This was reflected in reduced hospital admissions and IBD-related surgery and comorbidities, with associated reductions in direct and indirect costs of care compared with a more traditional patient-physician model.(187, 188) A cross-sectional survey conducted in the USA with 306 patients with autoimmune conditions, including 102 with IBD, examined the impact of SDM for biologic treatment selection and treatment outcomes.(189) Among the SDM participants, the mean number of treatments discussed with the physician was significantly higher than for the non-SDM group [2.8 vs 2.2, $p < 0.05$], more SDM participants reported thinking about the impact of a medication on the future than non-SDM participants [83.2% vs 72.6%, $p < 0.05$], and more SDM patients self-reported a likelihood of adherence to treatment compared with patients managed without SDM [$p = 0.001$].

Measuring the impact of changes in systems of care delivery can be challenging and data are largely limited to observational studies. A Norwegian cross-sectional survey examined health-related QoL outcomes amongst patients living with IBD who received solely physician-delivered care [n = 164] compared with those receiving care delivered by a team including physicians and IBD nurses [n = 140]. QoL outcomes were significant

better in the group receiving MDT care, although the magnitude of difference fell short of an *a priori* defined threshold of clinical significance.(190) A Belgian study [n = 1313 patients] reported that IBD nurse involvement in starting immunosuppressive therapy, follow-up care, flare management, and providing disease information and psychosocial support to patients systematically increased contact with patients, resulting in avoidance of emergency room and unscheduled outpatient visits.(191) In the UK, care of CD patients in a centre with an active MDT was associated with reduced excess exposure to corticosteroids.(192)

In recent years, dietitians have assumed a prominent role in the treatment of patients with CD, specifically in guiding the implementation of therapeutic diets, such as EEN, conducting assessments of nutritional status, and enhancing overall quality of care.(154) A real-world prospective study from Israel reported favourable outcomes amongst a cohort of newly diagnosed CD patients [n = 76] treated by MDT, including dietician input.(193) Other innovations in care delivery include increased use of remote monitoring and telemedicine. Two studies in paediatric populations (194, 195) revealed that telemedicine can support improved access to IBD services and improved attendance at follow-up appointments. An RCT of 909 patients in the Netherlands found that use of telemedicine to support patient self-management improved outcomes for patients with IBD compared with standard care, including reductions in the number of outpatient visits and number of hospital admissions.(196) In a similar manner, a retrospective multicentre cohort study revealed increased treatment success amongst 69 patients managed through a virtual clinic whilst undergoing dose optimization of anti-TNF therapy for CD when compared with 80 patients receiving standard outpatient care.(197)

It is recognized that not all centres have healthcare professionals across all the different MDT specialties. Nonetheless, efforts should be made to build a MDT with the widest range of specialities available. More research is needed on the role of different MDT members and different care-delivery models to understand long-term value for patients. In particular, better understanding of cost-effectiveness may help manage funding for implementation.

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3.10.2 The role of 'treat-to-target' and early treatment in the management of CD

Practice Point 6: *We recommend a tight control and treat-to-target approach for management of patients with CD. (Consensus: 97%)*

'Treat-to-target' describes an approach where a treatment goal is set and agreed upon following discussions between individual patients and treating clinicians, with one or more targets specified to measure progress towards that goal.(198) Following initiation of any therapy, these targets are then assessed with modification of treatment considered if a target is missed.(199) Significant improvement in medium- and long-term outcomes have been reported for patients when targeting more objective measures of inflammation [such as normalization of faecal calprotectin or serum CRP] when compared with subjective measures [such as clinical symptoms alone].(200, 201) Moreover, early combined immunosuppression followed by a treat-to-target approach is associated with reduced occurrence of surgery, reduced hospital admissions, and lower risk of serious disease-related complications.(202) Notably, the majority of evidence to date for a treat-to-target approach has been with anti-TNF therapy. Indeed, a treat-to-target strategy trial to guide ustekinumab dose escalation failed to show a benefit of more aggressive dose escalation driven by early endoscopy and more frequent clinical monitoring, although arguably the intensity of clinical monitoring was not substantially different between treatment arms.(203) There is still debate about what should be the optimal treatment target[s] in CD. There is also a lack of evidence to reassure patients and clinicians contemplating a change in treatment in the event of a partial response that falls short of meeting a target and where dose optimization has already occurred. Unlike in clinical trials, treatment targets should be individualized where possible and should be agreed upon as part of a SDM process between clinicians and patients. In addition, targets and goals of treatment should be regarded as dynamic and a decision can be made to change treatment targets over time.

Regardless of the monitoring strategy chosen, it is increasingly clear that early effective treatment should be a focus of management in CD with emphasis on avoidance of diagnostic delays and any delays in initiation of treatment. Chronic, untreated inflammation, even if asymptomatic, ultimately results in poor outcomes, whilst early control of inflammatory burden reduces the risk of long-term complications of disease.(200, 204) Typically, effectiveness of the drugs discussed in these guidelines appears to be greater when used earlier in disease course.(205) Consequently, clinicians should work to ensure rapid access for patients with suspected CD to appropriate diagnostic tests and clinical expertise, with urgent consideration of early treatment.

Whilst previous trials have hinted at the effectiveness of such an approach,(135, 206) the recently reported UK PROFILE trial provides important evidence in favour of early aggressive treatment of CD. PROFILE enrolled patients with moderate-to-severe CD at a median of just 12 days after diagnosis(7). Patients received initial corticosteroid therapy and were randomized. A total of 193 patients received 'accelerated step-up' care, with steroid taper alongside protocol-defined follow up, further corticosteroids and initiation of immunomodulator therapy in the event of a flare, and then anti-TNF therapy in the event of a further flare. In the other arm, 193 patients received 'top-down' combination therapy with IV infliximab and immunomodulator therapy and could taper the initial corticosteroid course more rapidly. The primary endpoint of sustained steroid and surgery-free remission to week 48 was more frequent in the 'top-down' than in the 'accelerated step-up' arm [79% vs 15%, $p < 0.001$]. Endoscopic remission was more frequent in 'top-down' arm [67% vs 44%, $p < 0.001$], with similarly positive data for QoL endpoints, avoidance of admissions, and reduction in CD-related surgery.

When patients are started on any treatment, clear definitions should be set as to how and when treatment success will be defined and assessed, with a focus on prompt actions in the event of treatment non-response. Notably, for these guidelines the consensus group chose to remove from all recommendations a need for patients to have 'failed', proven intolerant to, or have contraindications to 'conventional' therapy. This decision reflects a growing unease with the term 'conventional therapy', as many of the treatments discussed in these guidelines can now be regarded as forming an established part of the 'conventional' management of CD. Therefore, whilst these guidelines have appraised the available evidence for a range of treatments used in the management of CD, it remains for local payers to consider the health economic impacts, the disease burden, and the impact on long-term outcomes of mandating treatment cycles with treatments receiving only a weak recommendation in these guidelines.

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4. Conflicts of interest

ECCO has diligently maintained a disclosure policy of potential conflicts of interests [CoI]. The conflict-of-interest declaration is based on a form used by the International Committee of Medical Journal Editors [ICMJE]. The CoI disclosures are not only stored at the ECCO Office and the editorial office of JCC, but are also open to public scrutiny on the ECCO website [https://www.ecco-ibd.eu/about-ecco/ecco-disclosures.html], providing a comprehensive overview of potential conflicts of interest of the authors.

5. Disclaimer

The ECCO Guidelines are targeted at health care professionals only and are based on an international consensus process.

This process includes intensive literature research as explained in the methodology section and may not reflect subsequent scientific developments, if any, until the next Guidelines update is prepared. Readers of the Guidelines acknowledge that research about medical and health issues is constantly evolving and diagnoses, treatments, and dose schedules for medications are being revised continually. Therefore, the European Crohn´s and Colitis Organisation (ECCO) encourages all readers to also consult the most up-to-date published product information and data sheets provided by the manufacturers as well as the most recent codes of conduct and safety regulations.

Any treatment decisions are to be made at the sole discretion and within the exclusive responsibility of the individual clinician and should not be based exclusively on the content of the ECCO Guidelines. The European Crohn´s and Colitis Organisation (ECCO) and/or any of its staff members and/or any consensus contributor may not be held liable for any information published in good faith in the ECCO Consensus Guidelines. ECCO makes no representations or warranties, express or implied, as to the accuracy or completeness of the whole or any part of the Guidelines. ECCO does not accept, and expressly disclaims, responsibility for any liability, loss or risk that may be claimed or incurred as a consequence of the use or application of the whole or any part of the Guidelines.

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7. Data availability statement

Summary of findings tables (SOFs) produced for GRADE meta-analyses are available as online supplementary material (insert link).

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