CARBOplatin (AUC 2) weekly and PACLitaxel 80mg/m^2 followed by Dose Dense DOXOrubicin cycloPHOSphamide Therapy - Triple Negative Breast Cancer Therapy

INDICATIONS FOR USE:

INDICATION	ICD10	Regimen Code	HSE approved reimbursement status*
Neoadjuvant treatment of triple negative breast carcinoma	C50	00734a	N/A

*This applies to post 2012 indications

TREATMENT:

The starting dose of the drugs detailed below may be adjusted downward by the prescribing clinician, using their independent medical judgement, to consider each patients individual clinical circumstances.

CARBOplatin and PACLitaxel are administered on days 1, 8 and 15 of a 21 day cycle for 4 cycles or until disease progression or unacceptable toxicity develops.

This is then followed by DOXOrubicin and cycloPHOSphamide administered once every 14 days for 4 cycles (one cycle = 14 days).

G-CSF support (using standard or pegylated form) is required with all cycles of dose dense chemotherapy.

Facilities to treat anaphylaxis MUST be present when systemic anti-cancer therapy (SACT) is administered.

4 Cycles of PACLitaxel/CARBOplatin (Cycles 1-4 of treatment)

Admin. Order	Day	Drug	Dose	Route	Diluent & Rate	Cycle
1	1,8,15	PACLitaxel	80mg/m^2	IV infusion	250mL NaCl 0.9% over 60 minutes	Repeat every 21 days for cycles 1 - 4
2	1,8,15	CARBOplatin	AUC 2	IV infusion	250mL glucose 5% over 30 minutes	Repeat every 21 days for cycles 1 - 4
PACLitaxel must be supplied in non-PVC containers and administered using non-PVC giving sets and through an in-line 0.22 µm filter with a microporous membrane.						
PACLitaxel should be diluted to a concentration of 0.3-1.2mg/mL. Patients who experience hypersensitivity reactions to PACLitaxel may be considered for a switch to nab-PACLitaxel. Please see link to guidance document - Available on the NCCP website						

Note: Administration volumes and fluids have been standardised to facilitate electronic prescribing system builds.

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4 Cycles of DOXOrubicin/cycloPHOSphamide (Cycles 5-8 of treatment)

Admin. Order	Day	Drug	Dose	Route	Diluent & Rate	Cycle
1	1	DOXOrubicin[a]	60mg/ m^2	IV push	N/A	Repeat every 14 days for cycles 5 - 8
2	1	cycloPHOSphamide	600mg/m^2	IV infusion[b]	250mL NaCl 0.9% over 30 minutes	Repeat every 14 days for cycles 5 - 8
[a] cycloPHOSphamide may also be administered as an IV bolus over 5-10 minutes.						
[b] Lifetime cumulative dose of DOXOrubicin is 450mg/m^2. In establishing the maximal cumulative dose of an anthracycline, consideration should be given to the risk factors outlined below[i] and to the age of the patient.						

Note: Administration volumes and fluids have been standardised to facilitate electronic prescribing system builds.

CARBOplatin dose:

The dose in mg of CARBOplatin to be administered is calculated as follows:

Dose (mg) = target AUC (mg/mL x min) x (GFR mL/minute +25)

- **Measured GFR** (e.g. nuclear renogram) is preferred whenever feasible.
- Estimation of GFR (eGFR) can be done by using the Wright formula or using the Cockcroft and Gault formula to measure creatinine clearance.
- The GFR used to calculate the AUC dosing should not exceed 125mL/minute.
- For obese patients and those with a low serum creatinine, for example due to low body weight or post-operative asthenia, estimation using formulae may not give accurate results; measured GFR is recommended.
    - Where obesity (body mass index [BMI] ≥ 30 kg/m^2) or overweight (BMI 25-29.9) is likely to lead to an overestimate of GFR and isotope GFR is not available, the use of the adjusted ideal body weight for Cockcroft and Gault may be considered.
    - Where serum creatinine is less than 63 micromol/L, the use of a creatinine value of 62 micromol/L or a steady pre-operative creatinine value may be considered.
- These comments do not substitute for the clinical judgement of a physician experienced in prescription of CARBOplatin.

WRIGHT FORMULA

There are two versions of the formula depending on how serum creatinine values are obtained, by the kinetic Jaffe method or the enzymatic method. The formula can be further adapted if covariant creatine kinase (CK) values are available (not shown).

1. *SCr measured using enzymatic assay.*

GFR (mL/minute) = (6230 - 32.8 x Age) x BSA x (1 - 0.23 x Sex)

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SCr (micromol/min)

2. *SCr measured using Jaffe assay*

$$\text{GFR (mL/minute)} = \frac{(6580 - 38.8 \times \text{Age}) \times \text{BSA} \times (1 - 0.168 \times \textit{Sex})}{\text{SCr (micromol/min)}}$$

Key: Sex = 1 if female, 0 if male; Age in years; BSA= DuBois BSA

COCKCROFT-GAULT FORMULA

$$\text{GFR (mL/min)} = \frac{S \times (140 - \text{age in years}) \times \text{wt (kg)}}{\text{serum creatinine (micromol/L)}}$$

S = 1.04 for females and 1.23 for males

ELIGIBILITY:

- Indication as above
- ECOG status 0-2
- Adequate organ function; ANC > 1.5 x10^9/L, platelets 75 x10^9/L

EXCLUSIONS:

- Hypersensitivity to CARBOplatin*, PACLitaxel, DOXOrubicin, cycloPHOSphamide or any of the excipients
- Congestive heart failure (LVEF < 50%) or other significant heart disease
- Disease progression while receiving platinum based chemotherapy
- Pregnancy or lactation
- Severe hepatic impairment (PACLitaxel)
- Baseline neutrophil count < 1.5 x 10^9/L

  *If it is felt that the patient may have a major clinical benefit from CARBOplatin, it may in exceptional circumstances be feasible to rechallenge a patient with a prior mild hypersensitivity reaction e.g. using a desensitisation protocol, but only with immunology advice, premedication as advised, and a desensitisation protocol under carefully controlled conditions with resuscitation facilities available and medical and/or ITU/ HDU supervision

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PRESCRIPTIVE AUTHORITY:

The treatment plan must be initiated by a Consultant Medical Oncologist.

TESTS:

Baseline tests:

- FBC, liver and kidney profile
- Audiometry and creatinine clearance as clinically indicated
- ECG
- MUGA, ECHO as clinically indicated
- Isotope GFR measurement (preferred) or GFR / CrCl estimation

Regular tests:

- FBC weekly during treatment
- Liver and kidney profiles weekly
- Assessment of peripheral neuropathy status as clinically indicated (PACLitaxel only)
- MUGA, ECHO as clinically indicated

Disease monitoring:

Disease monitoring should be in line with the patient's treatment plan and any other test/s as directed by the supervising Consultant.

DOSE MODIFICATIONS:

- Any dose modification should be discussed with a Consultant.

Haematological:

Table 1: Dose modifications of PACLitaxel and CARBOplatin for haematological toxicity

ANC (x 10^9/L) Pretreatment blood test	
≥1.0	100% dose
0.5 to < 1.0	Delay treatment until recovery
< 0.5	Delay treatment until recovery and consider reducing PACLitaxel and CARBOplatin by 25% for subsequent cycles
Febrile neutropenia or previous delay for myelosuppression	Delay treatment until recovery and consider reducing PACLitaxel and CARBOplatin by 25% for subsequent cycles
Prolonged recovery greater than two weeks delay or 3rd delay for myelosuppression	Delay treatment until recovery, consider reducing PACLitaxel and CARBOplatin by 50% for subsequent cycles or cease
Platelets (x 10^9/L) Pretreatment blood test	
≥ 100	100% dose
75 to < 100	Clinician's discretion; continue treatment if patient is clinically well.
50 to < 75	Delay treatment until recovery
< 50	Delay treatment until recovery and consider reducing PACLitaxel and CARBOplatin by 25% for subsequent cycles

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Table 2: Dose modification of DOXOrubicin and cycloPHOSphamide for haematological toxicity

ANC (x 10^9 /L)		Platelet count (x 10^9 /L)	Dose
≥ 1.0	and	≥ 100	100%
< 1.0	and	≥ 100	Delay for 1 week (or longer if needed), then give 100% dose if ANC > 1.0 and platelets ≥ 100.
≥ 1.0	and	< 100	Delay for 1 week (or longer if needed), then give 100% dose if ANC > 1.0 and platelets ≥ 100. Dose reduce to 75% after a second delay.

Renal and Hepatic Impairment:

Table 3: Dose modification in renal and hepatic impairment

Drug	Renal Impairment		Hepatic Impairment			
CARBOplatin[a]	See note below*		No dose modification required			
PACLitaxel[b]	Renal impairment: no need for dose adjustment is expected. Haemodialysis: no need for dose adjustment is expected.		**ALT**		**Total Bilirubin**	**Dose**
			< 10xULN	and	≤ 1.25xULN	80mg/m^2
			< 10xULN	and	1.26-2xULN	60mg/m^2
			< 10xULN	and	2.01-5xULN	40mg/m^2
			≥10xULN	and /or	>5xULN	Not recommended
cycloPHOSphamide[c]	**CrCl (mL/min)**	**Dose**	Mild and moderate: no need for dose adjustment is expected. Severe: not recommended, due to risk of reduced efficacy.			
	≥ 30	100%				
	10-29	Consider 75% of the original dose.				
	< 10	Not recommended. If unavoidable consider 50% of the original dose.				
	Haemodialysis	Not recommended. If unavoidable consider 50% of the original dose.				
DOXOrubicin[d]	**CrCl (mL/min)**	**Dose**	**Serum Bilirubin (micromol/L)**			**Dose**
			20-50			50%
	>10	No dose	> 51-86			25%

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		adjustment is needed.		
	<10	No need for dose adjustment is expected.	> 86 or Child Pugh C	Not recommended
	Haemodialysis	75% of the original dose may be considered.		
[a] Renal – see note below*, hepatic – Giraud et al 2023 [b,c,d] Renal and hepatic dose modifications from Giraud et al 2023				

***Renal Dysfunction and CARBOplatin**

- Patients with creatinine clearance values of <60mL/min are at greater risk to develop myelosuppression.
- If GFR between 20 to ≤ 30mL/minute, CARBOplatin should be administered with extreme caution
- If GFR ≤ 20mL/minute, CARBOplatin should not be administered at all
- If Cockcroft & Gault or Wright formula are used, the dose should be adjusted as required per cycle based on a serum creatinine obtained within 48 hrs of drug administration.
- If isotope GFR is used, the dose should remain the same provided the serum creatinine is ≤110% of its value at the time of the isotope measurement. If the serum creatinine is higher than this, consideration should be given to re-measuring the GFR or to recalculating using Cockcroft & Gault or Wright formulae.

Management of adverse events:

Table 4: Dose Modification of PACLitaxel for Adverse Events

Adverse reactions	Recommended dose modification
Grade ≥2 motor or sensory neuropathy First Occurrence Persistent Grade ≥2 or 2nd occurrence	 Decrease dose of PACLitaxel by 10mg/m^2. Decrease dose of PACLitaxel by a further 10mg/m^2
All other grade 2 non-haematological toxicity	Hold treatment until toxicity resolves to ≤ grade 1. Decrease subsequent doses by 10mg/m^2.
≥ Grade 3 reaction	Discontinue

Patients who cannot tolerate treatment after 2 dose reductions or require a treatment delay of greater than 2 weeks, should discontinue treatment

SUPPORTIVE CARE:

EMETOGENIC POTENTIAL:

As outlined in NCCP Classification Document for Systemic Anti Cancer Therapy (SACT) Induced Nausea and Vomiting - Available on the NCCP website

CARBOplatin: Moderate **(Refer to local policy)**
PACLitaxel: Low **(Refer to local policy)**

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cycloPHOSphamide/DOXOrubicin : High **(Refer to local policy)**

For information:
Within NCIS regimens, antiemetics have been standardised by Medical Oncologists and Haemato-oncologists and information is available in the following documents:

- NCCP Supportive Care Antiemetic Medicines for **Inclusion in NCIS** (Medical Oncology) - Available on the NCCP website
- NCCP Supportive Care Antiemetic Medicines for **Inclusion in NCIS** (Haemato-oncology) - Available on the NCCP website

PREMEDICATIONS:

- All patients must be premedicated with corticosteroids, antihistamines, and H_2 antagonists prior to first dose of PACLitaxel treatment.
- The H_2 antagonist, famotidine, can potentially be omitted from the pre-medication requirements for PACLitaxel but the risk of hypersensitivity with this approach is unknown.
    - Caution is advised particularly for patients receiving PACLitaxel every 3 weeks. It is recommended that if famotidine is omitted that patients are monitored closely for any signs of hypersensitivity. Any hypersensitivity should be managed as per local policy.
    - Where a patient experiences hypersensitivity, consider the use of alternative H_2 antagonists **(Refer to local policy).**

Table 5 outlines the suggested premedications prior to treatment with PACLitaxel.

Table 5: Suggested premedications prior to treatment with PACLitaxel

Day of treatment	Drug	Dose	Administration prior to PACLitaxel
Day 1	dexAMETHasone[a]	8mg IV	30 minutes
Day 1	Chlorphenamine	10mg IV	30 minutes
Day 1	Famotidine	20mg IV	30 minutes
Day 8[b] and thereafter	dexAMETHasone[a]	None	
Day 8 and thereafter	Chlorphenamine	10mg IV	30 minutes
Day 8 and thereafter	Famotidine[c]	20mg IV	30 minutes
[a]Dose of dexAMETHasone may be altered, in the event of hypersensitivity reaction, to 20 mg of dexAMETHasone orally 12 hr and 6 hr prior to re-challenge with PACLitaxel according to consultant guidance.			
[b]Dose of dexAMETHasone may be added from day 8 if increased risk or previous hypersensitivity reaction according to consultant guidance.			
[c]Dose of famotidine may be omitted in the absence of hypersensitivity reaction according to consultant guidance.			

OTHER SUPPORTIVE CARE:

- Myalgias and arthralgias may occur with PACLitaxel. Analgesic cover should be considered.
- Patients should have an increased fluid intake of 2-3 litres on day 1 to prevent haemorrhagic cystitis associated with cycloPHOSphamide.

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ADVERSE EFFECTS

- Please refer to the relevant Summary of Product Characteristics (SmPC) for details.

DRUG INTERACTIONS:

- Current SmPC and drug interaction databases should be consulted for information.

REFERENCES:

1. Sikov et al. Impact of the addition of carboplatin and or bevacizumab to neoadjuvant once per week paclitaxel followed by dose dense AC on pathologic complete response rates in stage II to III TNBC: CALGB 40603 (alliance). J Clin Oncol. 2015 Jan 1; 33(1): 13–21.
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5. NCCN CARBOplatin Dosing in Adults available here https://www.nccn.org/docs/default-source/clinical/order-templates/appendix_b.pdf?sfvrsn=6286822e_6
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7. Giraud E L, Lijster B D, et al. Dose recommendations for anticancer drugs in patients with renal or hepatic impairment: an update. Available at: https://pubmed.ncbi.nlm.nih.gov/37269847
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9. CARBOplatin 10mg/mL Concentrate for Solution for Infusion. Summary of Product Characteristics. Last updated 22/03/2023. Accessed September 2024. Available at: https://www.hpra.ie/img/uploaded/swedocuments/LicenseSPC_PA0437-017-002A_25062018161037.pdf
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12. cycloPHOSphamide (Endoxana®) Injection 500mg Powder for Solution for Injection. Summary of Product Characteristics. Last updated 21/12/2018. Accessed September 2024. Available at:

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Version	Date	Amendment	Approved By
1	26/09/2023		Prof Maccon Keane
1a	27/05/2024	Amended title.	Prof Maccon Keane
2	09/12/2024	Reviewed.Updated exclusions section. Updated baseline and regular tests section. Updated emetogenic potential section. Updated other supportive care. Updated regimen in line with NCCP standardisation.	Prof Maccon Keane
3	12/09/2025	Addition of footnote to treatment table regarding hypersensitivity reactions. Amendment to baseline testing section. Standard wording update for CARBOplatin dosing guidance.	Prof Maccon Keane

Comments and feedback welcome at oncologydrugs@cancercontrol.ie.

[i] Cardiotoxicity is a risk associated with anthracycline therapy that may be manifested by early (acute) or late (delayed) effects.

Risk factors for developing anthracycline-induced cardiotoxicity include:
- high cumulative dose, previous therapy with other anthracyclines or anthracenediones
- prior or concomitant radiotherapy to the mediastinal/pericardial area
- pre-existing heart disease
- concomitant use of other potentially cardiotoxic drugs

In establishing the maximal cumulative dose of an anthracycline, consideration should be given to the risk factors above and to the age of the patient.

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