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ORIGINAL RESEARCH

Best Practice Approach to Successful Conversion of Fosaprepitant to Aprepitant IV in a Large Multisite Community Oncology Infusion Center: A Retrospective Analysis

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ABSTRACT

Purpose: To evaluate the impact on cost, time, resource use, and clinic workflow of converting the route of drug administration from a neurokinin-1 receptor antagonist (NK-1 RA) 30-min intravenous (IV) infusion to aprepitant IV, and more specifically to IV push, within a multicenter community oncology practice.

Methods: This was a retrospective, multicenter time, motion, and resource/cost evaluation study. Conversion to aprepitant IV was determined by calculating number of doses of aprepitant IV versus fosaprepitant administered in patients receiving moderately or highly emetogenic chemotherapy regimens. Operational advantages (i.e., supply costs, time saved) of switching from fosaprepitant IV infusion to aprepitant administered as a 2-min IV push were assessed.

Results: A total of 12,908 doses of aprepitant IV 130 mg were administered at 13 Rocky Mountain Cancer Centers clinics over an 18-month period. Conversion from fosaprepitant to aprepitant IV reached 90% after 9 months of aprepitant IV initiation. Supply costs per administration were reduced ($2.51 to $0.52) when aprepitant was prepared as an IV push versus an NK-1 RA infusion. The overall time savings per administration of aprepitant was reduced by 90% (from 36.5 to 3.5 min, 33 min saved) as an IV push rather than an infusion. Most of the time saved per administration (30 min) pertained to the infusion nurse, and 3 min was saved by the pharmacy technician.

Conclusion: Successful conversion to aprepitant, and specifically to a 2-min IV push, provides time, cost, and resource savings, improves operational efficiency, and avoids the negative impact of potential future IV fluid shortages.

PLAIN LANGUAGE SUMMARY

Chemotherapy-induced nausea and vomiting (CINV) can have a major impact on quality of life for patients receiving chemotherapy. Intravenous (IV) aprepitant is an approved neurokinin-1 receptor antagonist (NK-1 RA) that has been effective and safe when administered as part of a guideline-recommended regimen in patients receiving chemotherapy. In addition to being approved as a 30-min infusion, aprepitant

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IV is the only NK-1 RA approved for administration as a 2-min injection. These factors contributed to Rocky Mountain Cancer Centers (RMCC), which is a physician-owned community oncology practice, evaluating the impact on cost, time, and resource use of converting from a 30-min infusion of fosaprepitant to aprepitant IV, and more specifically a 2-min injection. Within 9 months of implementing aprepitant IV at RMCC, the percent utilization compared to fosaprepitant reached over 90%, signifying a successful conversion within the practice. Furthermore, a 2-min injection of aprepitant IV resulted in several operational advantages compared to a 30-min infusion. When accounting for all 13 clinics within RMCC, total monthly time savings to the practice would be over 28,000 min, or approximately 60 workdays per month of saved time. This new workflow is more efficient and allows for pharmacy technicians to complete other necessary tasks in the pharmacy such as cleaning, organizing, managing inventory, drug ordering, and charge/documentation corrections. Time saved by the nurses could be used for enhanced patient care, thoroughly reviewing chemotherapy or other orders, and assisting other nurses.

Keywords: Aprepitant; CINV; Fosaprepitant; Infusion; IV push; Time and cost savings

Key Summary Points

The safe formulation of aprepitant IV and being approved as a 2-min IV push and 30-min infusion were critical factors contributing to stakeholder effort and integration of a plan to convert from fosaprepitant IV to aprepitant IV at Rocky Mountain Cancer Centers.

Successful conversion from fosaprepitant to aprepitant IV was determined if/when aprepitant utilization reached 90% compared to fosaprepitant IV; this occurred within 9 months of initial aprepitant utilization.

Use of aprepitant IV push resulted in a significant impact on workflows (cost and time savings) while addressing the significant infusion bag shortage.

Operational advantages from utilization of aprepitant IV push allow for greater efficiency by allowing staff to see and treat more patients in a timelier fashion.

INTRODUCTION

Chemotherapy-induced nausea and vomiting (CINV) can have a major impact on the quality of life for patients receiving chemotherapy and results in poor adherence to chemotherapy treatments if not properly treated. CINV can be classified in multiple ways, including (1) anticipatory, or a conditioned response from a prior episode of CINV and usually triggered by consistent stimuli; (2) acute, occurring within 24 h of chemotherapy administration; or (3) delayed, occurring at least 24 h after chemotherapy administration. Chemotherapy regimens can be classified as having high, moderate, low, or minimal risk of emetogenicity [1].

Given the successful outcomes with neurokinin-1 receptor antagonists (NK-1 RAs) for preventing acute and delayed-onset CINV due to both moderately emetogenic chemotherapy (MEC) [2–4] and highly emetogenic chemotherapy (HEC) [5–7], this class of drugs has become an integral component of many treatment regimens and pathways within Rocky Mountain Cancer Centers (RMCC) electronic medical record (EMR).

Aprepitant IV is an NK-1 RA, indicated for use in adults in combination with other antiemetic agents, for the prevention of acute and delayed nausea and vomiting associated with initial and repeat courses of HEC and MEC regimens. Aprepitant IV is formulated utilizing lipid components with a long history of use in parenteral products, such as IV nutrition and is well tolerated [8]. This is in contrast to other NK-1 RAs, which contain synthetic surfactants

such as fosaprepitant, which includes polysorbate 80 or povidone [9, 10]. The National Comprehensive Cancer Network (NCCN) antiemetic guidelines gave aprepitant 130 mg IV (aprepitant injectable emulsion) a category 1 recommendation as an NK-1 RA within an antiemetic regimen for patients receiving HEC or MEC [1]. It is available as a single-dose 130 mg/18 mL injectable emulsion and approved for administration either as an IV push of 130 mg over 2 min or an infusion over 30 min prior to chemotherapy on day 1 [11–14]. The IV push administration of aprepitant was approved on the basis of a phase 1, single-center, randomized, two-part crossover study that demonstrated pharmacokinetic bioequivalence and tolerability when compared to administration via IV infusion [11].

Fosaprepitant is available as a single-dose 150-mg lyophilized powdered vial requiring reconstitution with 5 mL of 0.9% sodium chloride, followed by dilution in 145 mL of 0.9% sodium chloride to a final concentration of 1 mg/mL. Fosaprepitant is approved for administration as a 150-mg intravenous infusion over 20–30 min prior to chemotherapy on day 1 [9].

RMCC, which has over 80 providers and 700+ employees leading 13 infusion clinics, was heavily impacted by the nationwide acute shortage of small-volume parenteral solutions resulting from the aftermath of Hurricane Maria (September 2017) that disrupted manufacturing and distribution of products coming from Puerto Rico. This disruption in the supply chain significantly affected healthcare institutions [15, 16]. As a result of the severity of the shortage, the American Society of Health-System Pharmacists (ASHP) recommended switching the delivery of treatments by infusion to IV push whenever possible [15]. Furthermore, the US Oncology Network placed all IV fluids on allocation. RMCC, which is part of the US Oncology Network, responded by ordering fluids from a centralized position to mitigate the negative impact.

Leading up to this analysis (based on the 6 months of administration data leading up to the start of the data collection period), collectively across all 13 infusion clinics, administration of fosaprepitant as an IV averaged 533 doses/month. The fluid shortages triggered RMCC to explore alternative strategies (e.g., other NK-1 RAs, different type of administration) for conserving product and eliminating unnecessary usage and waste. Like other practices, RMCC chose to eliminate the standard use of 250-mL saline flush bags, utilized professional judgment to combine medications when possible, and administered premedications as an IV push if supported by the manufacturer and clinical studies. Because aprepitant IV has been approved to be administered as a 2-min IV push in addition to a 30-min infusion [17], this retrospective analysis evaluated the potential time and cost savings benefits of aprepitant administered as a 2-min IV push.

METHODS

This was a retrospective, multicenter, time–motion, and cost-effectiveness analysis at RMCC, which is a physician-owned community oncology practice that operates 13 separate infusion clinics. Dispensing data were extracted from the automated dispensing cabinet (ADC) software, which provided the number of doses of aprepitant IV versus fosaprepitant administered during the 18-month collection period. This allowed for calculation of the proportional usage of aprepitant versus fosaprepitant (Table 1) per individual clinic (Table 2). The start of use of IV aprepitant varied across clinics during the 18-month collection period; therefore, the average number of aprepitant IV administrations in certain clinics was calculated based on different time periods ranging from 14 to 18 months. A successful conversion was defined as $\geq$ 90% usage of aprepitant IV among the NK-1 RA class.

The implementation of the plan to convert to aprepitant IV was undertaken in a methodical and conservative manner by RMCC for a presumed higher chance of success. Transmission of information took place in board/committee meetings, clinic operational meetings, nursing in-services conducted by pharmacists in conjunction with Medical Science Liaisons (MSLs) from the manufacturer, and multiple email blast communications. Those identified

Table 1 Practice breakdown of conversion from fosaprepitant to aprepitant IV at Rocky Mountain Cancer Centers

Aprepitant conversion practice breakdown[a]					
Fiscal year Qtr	**Month**	**NK-1 RA doses administered**			**Percentage aprepitant usage (%)**
		Fosaprepitant 150 mg INJ	**Aprepitant 130 mg INJ**	**Total NK-1 RA**	
Qtr1, FY19	Apr-18	616	0	616	0.0
	May-18	731	25	756	3.3
	Jun-18	665	48	713	6.7
Qtr2, FY19	Jul-18	657	194	851	22.8
	Aug-18	446	486	932	52.1
	Sep-18	172	1101	1273	86.5
Qtr3, FY19	Oct-18	156	359	515	69.7
	Nov-18	104	884	988	89.5
	Dec-18	93	781	874	89.4
Qtr4, FY19	Jan-19	56	974	1030	*94.6*
	Feb-19	48	847	895	*94.6*
	Mar-19	52	965	1017	*94.9*
Qtr1, FY20	Apr-19	49	1122	1171	*95.8*
	May-19	45	1096	1141	*96.1*
	Jun-19	29	948	977	*97.0*
Qtr2, FY20	Jul-19	46	1010	1056	*95.6*
	Aug-19	51	1016	1067	*95.2*
	Sep-19	42	1052	1094	*96.2*

FY fiscal year, *INJ* injection, *IV* intravenous, *NK-1 RA* neurokinin-1 receptor antagonist, *Qtr* quarter

[a] Italic values indicate > 90% Clinic Market Share Conversion

as playing a role in the ordering, scheduling, preparation, and ultimate delivery/administration of aprepitant IV included providers, schedulers, patient financial counselors (PFCs), pharmacists, pharmacy technicians, and infusion nurses. The precise timing of each individual step of the process (preparation through administration) for a 30-min IV infusion compared to a 2-min IV push, and how this impacted all key stakeholders within the various clinic workflows, were calculated based on average times determined by spot-checking the steps at various clinics, and confirmed by key stakeholders. Impact was determined to include time saved versus expended, resources saved versus consumed, and how to effectively utilize additional time and resources saved for impacted disciplines. All workflow steps comparing preparation of an infusion to an IV push are summarized in Table 3.

All final product checks were completed by nursing, as RMCC does not have a pharmacist at each clinic location. Preparation of all aprepitant and fosaprepitant infusion doses was primarily completed by the pharmacy technicians and verified by nursing, while aprepitant IV push doses were prepared by infusion nurses. The preparation step for most premedications,

Table 2 Clinic breakdown of conversion from fosaprepitant to aprepitant IV at Rocky Mountain Cancer Centers

Month	Clinic breakdown																									
	Clinic 1		Clinic 2		Clinic 3		Clinic 4		Clinic 5		Clinic 6		Clinic 7		Clinic 8		Clinic 9		Clinic 10		Clinic 11		Clinic 12		Clinic 13	
	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A
Apr-18	77	NA	94	NA	18	NA	10	NA	6	NA	29	NA	33	NA	51	NA	78	NA	105	NA	41	NA	32	NA	42	NA
May-18	98	25	91	NA	25	NA	6	NA	4	NA	27	NA	52	NA	57	NA	66	NA	118	NA	74	NA	53	NA	60	NA
Jun-18	63	48	68	NA	23	NA	7	NA	6	NA	26	NA	42	NA	54	NA	60	NA	132	NA	64	NA	60	NA	60	NA
Jul-18	20	69	56	25	17	NA	4	NA	14	NA	35	NA	34	NA	85	NA	72	25	140	50	70	25	56	NA	54	NA
Aug-18	11	*131*	0	*51*	10	16	7	5	13	6	38	18	58	15	31	75	70	8	52	83	23	37	64	20	69	21
Sep-18	4	*232*	3	*128*	0	*34*	0	*7*	0	*16*	3	*43*	2	*64*	1	*142*	11	85	25	216	14	91	37	19	72	24
Oct-18	2	0	0	*10*	0	*5*	0	*3*	0	*6*	4	15	4	33	9	49	4	*68*	25	26	15	*66*	33	38	60	40
Nov-18	0	*101*	0	*80*	0	*40*	0	*10*	0	*10*	2	*36*	0	*47*	6	*66*	11	94	12	*164*	9	*118*	22	63	42	55
Dec-18	1	*91*	0	*71*	0	*17*	0	*10*	0	*6*	0	*33*	0	*70*	4	*73*	0	*88*	10	*126*	16	107	20	69	42	20
Jan-19	0	*102*	0	*88*	0	*39*	0	*13*	0	*7*	0	*31*	2	*92*	10	66	0	*101*	12	*172*	11	*127*	15	81	6	55
Feb-19	1	*78*	0	*69*	0	*33*	0	*7*	0	*6*	0	*46*	0	*82*	5	*65*	0	*96*	7	*155*	10	*93*	7	*72*	18	45
Mar-19	0	*112*	0	*72*	0	*35*	0	*8*	0	*8*	0	*35*	0	*76*	5	*103*	1	*119*	6	*174*	10	89	12	94	18	40
Apr-19	0	*103*	0	*70*	0	*55*	0	*9*	0	*16*	0	*35*	0	*110*	3	*146*	1	*118*	0	*206*	5	*113*	10	86	30	55
May-19	0	*110*	0	*77*	0	*53*	0	*12*	0	*19*	0	*36*	0	*72*	1	*132*	0	*126*	9	*205*	6	*97*	5	*91*	24	*66*
Jun-19	0	*82*	0	*71*	0	*41*	0	*11*	0	*11*	0	*29*	0	*71*	1	*124*	1	*97*	6	*183*	3	*83*	6	*85*	12	60
Jul-19	0	*87*	0	*78*	0	*46*	0	*10*	0	*14*	0	*29*	0	*67*	0	*133*	1	*111*	19	*175*	2	*101*	6	*99*	18	60
Aug-19	0	*104*	0	*69*	0	*38*	0	*20*	0	*31*	0	*27*	2	*74*	0	*129*	0	*123*	19	145	3	*90*	3	*96*	24	70
Sep-19	0	*96*	0	*74*	0	*44*	0	*22*	0	*26*	2	*42*	2	*98*	1	*141*	0	*119*	18	154	7	*104*	0	*86*	12	46

Table 2 continued

Month	Clinic breakdown																							
	Clinic 1		Clinic 2		Clinic 3		Clinic 4		Clinic 5		Clinic 6		Clinic 7		Clinic 8		Clinic 9		Clinic 10		Clinic 11		Clinic 12		Clinic 13	
	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A	F	A
Total use per clinic since conversion	1571		1033		496		147		182		455		971		1444		1378		2234		1341		999		657	
Average monthly use per clinic	92		68		35		10		13		32		73		103		91		148		89		71		46	
Total administrations of aprepitant during 18 month data collection							12,908																			
Overall average monthly use per clinic									67																	

Italic values indicate > 90% Clinic Market Share Conversion. Boxes that contain NA were not included in the calculation of average monthly use per clinic
A aprepitant (quantity of doses administered), *F* fosaprepitant (quantity of doses administered), *INJ* injectable (product formulation), *NA* not applicable, *NK-1 RA* neurokinin-1 receptor antagonist

Table 3 Workflow steps for preparation of intravenous infusion and push

Specific workflow steps and key stakeholders				30-min NK-1 RA IV infusion	2-min IV push of aprepitant
Steps IVF	**Steps IVP**	**Individual order process steps to complete**	**Key stakeholder**	**Required steps (Yes or No)**	
1	1	Order entered in EMR	Provider	Yes	Yes
2	2	Order received, processed, and reviewed	Pharmacist	Yes	Yes
3	3	Patient scheduled for treatment	Scheduler	Yes	Yes
4	4	Authorization obtained	Patient financial counselor	Yes	Yes
5	5	Product ordered from distributor/wholesaler	Admixture technician	Yes	Yes
6	6	Product received		Yes	Yes
7	7	Product stored under refrigeration and continuously monitored		Yes	Yes
8	8	Product entered inventory within ADC		Yes	Yes
9	9	Drug removed from ADC on day of treatment		Yes	Yes
10	10	Orders approved on day of treatment	Provider	Yes	Yes
		Infusion preparation	Admixture technician	Yes	No
12		PPE applied (aseptic technique/USP 797)		Yes	No
13		Prepared in small-volume piggyback solution		Yes	No
14		Final product check completed	Infusion nurse	Yes	No
15		Preparation delivered to infusion area		Yes	No
16		Gather and assemble infusion sets		Yes	No
17		Prime the pump/tubing		Yes	No
18		Hang IV infusion		Yes	No
19		Program pump infusion rate		Yes	No
20		Remove IV bag when completed and waste appropriately		Yes	No
		Syringe preparation		No	Yes
	11	PPE applied (aseptic technique/USP 797)		No	Yes
	12	Prepare syringe for IV push dose		No	Yes
	13	Inject aprepitant		No	Yes
21	14	Flush line		Yes	Yes
22	15	Document administration in the EMR		Yes	Yes

ADC automated dispensing cabinet, *EMR* electronic medical record, *IVF* intravenous infusion of fosaprepitant, *IVP* intravenous push of aprepitant, *USP* US Pharmacopeia

including aprepitant IV, took place in a segregated compounding area (SCA) that is primarily within the pharmacy area under aseptic conditions and staffed by trained personnel. Each preparation was provided with immediate-use Beyond-Use Dating (BUD) according to US

Pharmacopeia sterility limitations according to chapter 797 [18].

A supply cost comparison was conducted by gathering cost data from the McKesson wholesaler for all supplies used in aprepitant preparation both as an infusion and as a 2-min IV push. RMCC followed guidelines for safe injection practices created by the Institute for Safe Medication Practices (ISMP) and adhered to the US Centers for Disease Control and Prevention (CDC) use guidelines for safe injection practices and usage of vials [15, 19, 20].

This was a retrospective longitudinal analysis from a de-identified HIPAA-compliant claims database, so no institutional review board approval was necessary. It does not contain any studies with human participants or animals performed by the authors.

RESULTS

During the 18-month collection period from April 1, 2018, to September 30, 2019, RMCC clinics administered a total of 12,908 doses of aprepitant IV 130 mg, amounting to an average of 67 doses per month at each clinic. Overall, successful conversion (≥ 90%) from fosaprepitant to aprepitant IV across the clinics occurred 9 months after the initial dose of aprepitant IV (January 2019, Table 2). One clinic (clinic 13) was at 80% conversion at the end of the 18-month analysis (Table 2).

The supply cost comparisons for all supplies used for the preparation of aprepitant as a 30-min infusion versus a 2-min IV push are shown in Table 4. Necessary supplies identified included gloves, reusable gowns, syringes, needles, alcohol swabs, infusion bags, tubing, and patient labels. The cost of gowns was $3.57 per unit; this cost was excluded from the comparison since gowns were reused throughout the shift and for multiple preparations. Based on the data collected, the cost of supplies per preparation was reduced from $2.51 to $0.52, a supply cost savings of $1.99 per unit when aprepitant was prepared as an IV push versus an infusion (Table 4). When accounting for 13 separate infusion clinics, with an average of 67 monthly infusions per clinic the total monthly savings on supply costs to the practice would be $1,733.29, or $20,799.48 annually.

Regarding the workflow process, no difference existed with order entry, receiving, processing, storing, scheduling, authorization, and approving orders for aprepitant IV regardless of route of administration. In addition, time requirements for the steps of applying appropriate personal protective equipment (PPE), line flushing, and completing documentation within the EMR were similar for both aprepitant infusions and IV push. The substantial differences in time occurred with the preparation and administration of the aprepitant infusion versus drawing up aprepitant in a syringe for IV push (Table 5).

Preparation and administration of aprepitant IV as an infusion required 36.5 min within the workflow (3.5 min required by the pharmacy technician and 33 min by the infusion nurse). Conversely, when preparing and administering aprepitant as a 2-min IV push, time was reduced by 90% as only 3.5 min were required by the infusion nurse. The overall time savings per dose when preparing and administering

Table 4 Supply costs for aprepitant intravenous infusion and push preparation

Supply item*	Preparation cost per unit ($)	
	IV infusion	IV push
Single pair of gloves	0.16	0.16
20 ml Luer Lock plastic syringe (sterile)	0.27	0.27
18 ga needle (sterile)	0.04	0.04
Alcohol swab (sterile)	0.02	0.02
100 mL NS infusion bag (sterile)	1.22	NA
Secondary tubing set (sterile)	0.77	NA
Patient label	0.03	0.03
Total	2.51	0.52

IV intravenous, *NA* not applicable, *NS* normal saline
*Gowns cost $3.57 per unit; this cost was excluded from comparison because gowns are reused through shifts and for multiple preparations

Table 5 Preparation and administration time comparison for aprepitant*

Workflow step Nurse	Preparation time per unit (min) IV infusion	Preparation time per unit (min) IV push
Prepare in small-volume piggyback†	3	NA
Complete final product check	0.5	NA
Deliver to infusion area	0.5	NA
Gather/assemble infusion sets	0.5	NA
Prime the pump and tubing	0.5	NA
Hang infusion bag	0.5	NA
Program pump infusion rate	0.5	NA
Infuse aprepitant IV	30	NA
Remove when completed and waste	0.5	NA
Prepare syringe for IV push	N/A	1.5
Injection	N/A	2
Total	36.5	3.5

*Timing for each step was an average determined by spot-checking the steps at some locations and confirming with key stakeholders

† Performed by pharmacy technician

IV intravenous, *NA* not applicable

aprepitant as an IV push rather than an infusion was 33 min (3 min saved by the pharmacy technician and 30 min by the infusion nurse) (Table 5).

Furthermore, a reduction in workflow steps of 33 min per preparation multiplied by an average of 67 monthly administrations per clinic resulted in 2211 min saved per clinic per month. When accounting for 13 separate infusion clinics, the total monthly savings to the practice would be 28,743 min, or 479 h, or approximately 60 workdays per month of saved time. This new workflow is more efficient and allows for pharmacy technicians to complete other necessary tasks in the pharmacy such as cleaning, organizing, managing inventory, drug ordering, and charge/documentation corrections. Time saved by the nurses could be used for enhanced patient care, thoroughly reviewing chemotherapy or other orders, and assisting other nurses.

DISCUSSION

This retrospective analysis evaluated the conversion from administration of fosaprepitant to aprepitant IV at RMCC. Over an 18-month period after initiating utilization of aprepitant IV, RMCC had administered nearly 13,000 doses of aprepitant in 13 infusion clinics. Within 9 months of initial aprepitant IV utilization, percent utilization of aprepitant IV compared to fosaprepitant reached 90%, signifying a successful conversion within the practice. Only 1 out of 13 clinics (80%) did not achieve a 90% utilization of aprepitant IV by the end of the 18-month analysis. This potentially could have been due to payer preference, nursing preference, change resistance (patient preference or intolerance to aprepitant), or simply because this clinic was limited by being the farthest physical distance from pharmacy leadership. Preparation of aprepitant as an IV push compared to an infusion yielded decrease in supply cost savings per preparation ($1.99/unit, from $2.51 to $0.52). A greater impact was observed on the overall time saved; 90% (33 min per unit, 36.5 min to 3.5 min) when preparing and administering aprepitant as a 2-min IV push rather than a 30-min infusion. This time savings translated to freeing up approximately 60 workdays of combined pharmacist and nursing time for RMCC monthly.

Successful conversion was attributed to multiple routes of education and

communication with key stakeholders: providers, schedulers, PFCs, pharmacists, pharmacy technicians, and infusion nurses. Prior to administering the initial dose of aprepitant, the RMCC Pharmacy Team met with key stakeholders to gauge interest in selecting aprepitant as the preferred NK1-RA, and to discuss creation of a specific plan for how to successfully roll out its use within the clinics. RMCC began by collecting economic and clinical data and then presented this information to both the Managed Care and Clinical Quality committees for buy-in and approval. These committees were made up of physicians, advanced practice practitioners (APPs), pharmacists, and practice and nursing leadership. Other key decision makers included the Director of Operations, Controller, and billing team. After factoring in positive clinical outcomes, time savings, drug shortage concerns, and multiple delivery options, the key stakeholders agreed to move forward with selecting aprepitant as the preferred NK-1 RA.

The utilization of aprepitant IV as the preferred NK-1 RA at RMCC began in June of 2018. One critical factor in the successful conversion was the favorable safety profile of aprepitant IV compared to fosaprepitant. Clinical trials have shown that the use of fosaprepitant has been associated with infusion-site adverse events (ISAEs) [9], including infusion-site pain, erythema, swelling, venous hardening or induration, and phlebitis or thrombophlebitis. These ISAEs may be associated with the formulation of fosaprepitant, which contains the synthetic nonionic surfactant polysorbate 80 [21], an excipient composed of fatty acid esters and polyoxymethylene sorbitan [22]. Polysorbate 80 is a biologically and pharmacologically active compound that does not alter the pharmacologic properties of the drug with which it is formulated, but is itself associated with a number of adverse events (AEs). Aprepitant is free of synthetic surfactants and polysorbate 80, has demonstrated bioequivalence to fosaprepitant, and is associated with a lower risk for injection-site adverse and hypersensitivity reactions over injectable fosaprepitant when administered via a 30-min infusion [23, 24].

Aprepitant currently represents the only NK-1 RA that can be administered as both a 2-min IV push and a 30-min infusion. Consistent with presenting a tolerable safety profile when administered as a 30-min infusion [23–27], aprepitant administered as a 2-min IV push was well tolerated in healthy volunteers [28] and in patients with various cancer types receiving a range of HEC and MEC chemotherapy regimens [26, 29, 30]. The 2-min IV push administration of aprepitant offers a convenient method of administering an NK-1 RA for CINV prophylaxis, which has multifold implications. It addresses significant infusion bag shortages and complies with the ASHP recommendation of switching the administration of parenterally administered products to IV push whenever possible [15]. More importantly, and in line with findings of this study, this mode of administration confers operational advantages to pharmacies and infusion clinics. In the pharmacy, a 2-min IV push of aprepitant saves on preparation time, supplies (bags, tubing, etc.), and transit time to the infusion clinic. In the infusion clinic, the 2-min IV push administration of aprepitant allows savings on chair time that can be used for other purposes. Infusion clinics within RMCC have become increasingly busy despite the implementation of decoupling visits (labs/office visits held on a separate day than scheduled treatment) and streamlining the scheduling process. More than 20% of revenue generated in oncology practices comes from infusions [31], so the extra chair time saved could be reused for other billable procedures likely to be beneficial to the practice. Hence, all the saved time within the infusion clinics would allow for greater efficiency and prevent complicated bottlenecks and may allow each practice to see and treat a greater number of patients in a timelier fashion. As a practice that is almost entirely tied to value-based care (approximately 94% of payer contracts) and being the only Oncology Care Model (OCM) practice within the state of Colorado, this conversion supported RMCC's mission and strategic initiatives of improving the overall value and care that patients receive, while minimizing the impact of patient cost.

Looking more specifically into time saved, in terms of the pharmacist, it was determined that for RMCC, the impact was minimal when administering aprepitant as an IV push. Regardless of route of administration, a pharmacist must review and verify correct order entry. The current EMR allows for nursing to adjust aprepitant orders for preference (i.e., IV push or IV infusion). If premedications such as antiemetics were prepared in a primary engineering control (PEC) by a technician and then verified by a pharmacist, then switching to IV push administration would save substantial amounts of time. Approximately 7–10 min could be saved per preparation if made individually and not part of a batch. All additional time saved on the nursing side (whether via more efficient preparation or more efficient administration) was redirected toward focus on the patient and documentation within the patient EMR.

Despite requiring a great deal of effort and time to plan this conversion, it was ultimately a success and provided the pharmacy team with a high level of knowledge in determining overall positive impact to clinic workflows and identifying a best practice approach for implementing a new drug within a practice that could be replicated for future drug implementation initiatives. RMCC learned that by strategizing with larger committees and further collaborating with key stakeholders to gain necessary buy-in, the chances of a successful drug implementation initiative were greatly improved. Given the level of reach this initiative involved, it was imperative that pharmacy create a robust process for involvement, planning, communication, tracking, follow-up, and reporting. Careful planning and developing an implementation strategy allowed RMCC to successfully convert from administration of fosaprepitant infusions to IV push of aprepitant in a timely manner.

Limitations

The transition to aprepitant IV as RMCC's preferred NK-1 RA was an active conversion, and all usage of aprepitant IV during the data collection period was intentional. RMCC did participate in two small, separate drug buy-ins during the 18-month period, which totaled 615 vials (approximately 4.7% of total purchases). This is mentioned since having extra vials of drug on hand could have sped up utilization for some clinics.

RMCC did not collect a baseline of AEs related to fosaprepitant prior to the conversion, so no determination could be made whether a decrease in AEs to aprepitant IV was seen. However, RMCC did not notice a higher reporting of documented AEs related to aprepitant IV during the data collection period.

CONCLUSION

Based on the cost and time savings estimates, it was clear that significant impact on workflows could be gained if a practice chooses to convert from fosaprepitant infusions to aprepitant IV push for the prevention of acute and delayed-onset CINV associated with MEC and HEC treatment regimens.

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Data Availability. The datasets used and/or analyzed during the present study are available from the corresponding author upon reasonable request.

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